The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

November 1941

Ophthalmology . Gynecology

Gastrointestinal Surgery . Obstetrics

Orthopedics . New Instruments

Special Monograph

Cesarean Section. The Modern Operation

By CHARLES A. GORDON and ALEXANDER H. ROSENTHAL

The American Journal of Surgery, Inc.

49 WEST FORTY-FIFTH STREET · NEW YORK

EDITORIAL BOARD

The American Journal of Surgery

Editor THURSTON SCOTT WELTON, *New York*

ASSOCIATE EDITORS

CARL BECK, *Chicago*
CLAUDE S. BECK, *Cleveland*
GEORGE R. BRIGHTON, *New Yor*
MEREDITH F. CAMPBELL, *New Yor*
JAMES T. CASE, *Chicago*
ISIDORE COHN, *New Orleans*
BRADLEY L. COLEY, *New York*
FREDERICK A. COLLER, *Ann Arbor*
PAUL C. COLONNA, *Oklahoma City*
GEORGE W. CRILE, *Cleveland*
ELLIOTT C. CUTLER, *Boston*
CHARLES A. ELSBERG, *New York*
HERBERT C. FETT, *Brooklyn*
C. R. G. FORRESTER, *Chicago*
H. DAWSON FURNISS, *New York*
JOHN H. GIBBON, *Philadelphia*
EMIL GOETSCH, *Brooklyn*
CHARLES A. GORDON, *Brooklyn*
DONALD GUTHRIE, *Sayre, Pa.*
ARTHUR E. HERTZLER, *Kansas City*
LOUIS J. HIRSCHMAN, *Detroit*
JAMES M. HITZROT, *New York*
FREDERICK C. HOLDEN, *New York*
EMILE F. HOLMAN, *San Francisco*
JOSEPH A. HYAMS, *New York*
JOHN E. JENNINGS, *Brooklyn*
Washington, WILLIAM L. KELLER
Baltimore, HOWARD A. KELLY
New York, THOMAS J. KIRWIN
New York, ARTHUR KRIDA
New York, ADRIAN V. S. LAMBERT
New York, MAURICE LENZ
New York, H. H. M. LYLE
New York, JEROME M. LYNCH
New Orleans, URBAN MAES
Newark, HARRISON S. MARTLAND
New Orleans, RUDOLPH MATAS
Detroit, ROY D. MCCLURE
San Francisco, H. C. NAFFZIGER
Baltimore, EMIL NOVAK
Newark, CLARENCE R. O'CROWLEY
Boston, LOUIS E. PHANEUF
New York, EUGENE H. POOL
Rochester, Minn., JAMES T. PRIESTLEY
New York, DOUGLAS QUICK
Brooklyn, NATHANIEL P. RATHBUN
Raleigh, HUBERT A. ROYSTER
Philadelphia, HENRY S. RUTH
St. Louis, M. G. SEELIG
New York, J. BENTLEY SQUIER
New York, H. J. STANDER
Baltimore, GRANT E. WARD
J. HOMER WOOLSEY, *San Francisco*

The American Journal of Surgery is published monthly by the American Journal of Surgery, Inc., 49 West 45th Street, New York, N. Y. Yearly Subscription, $10.00 U. S. A.; $15.00 Canada; $12.00 Foreign. Single Numbers $2.00; Special Numbers $4.00. Entered as second class matter August 28, 1926, at the Post Office, New York, N. Y., under the act of March 3, 1879. November, 1941—New Series, Volume LIV, No. 2.

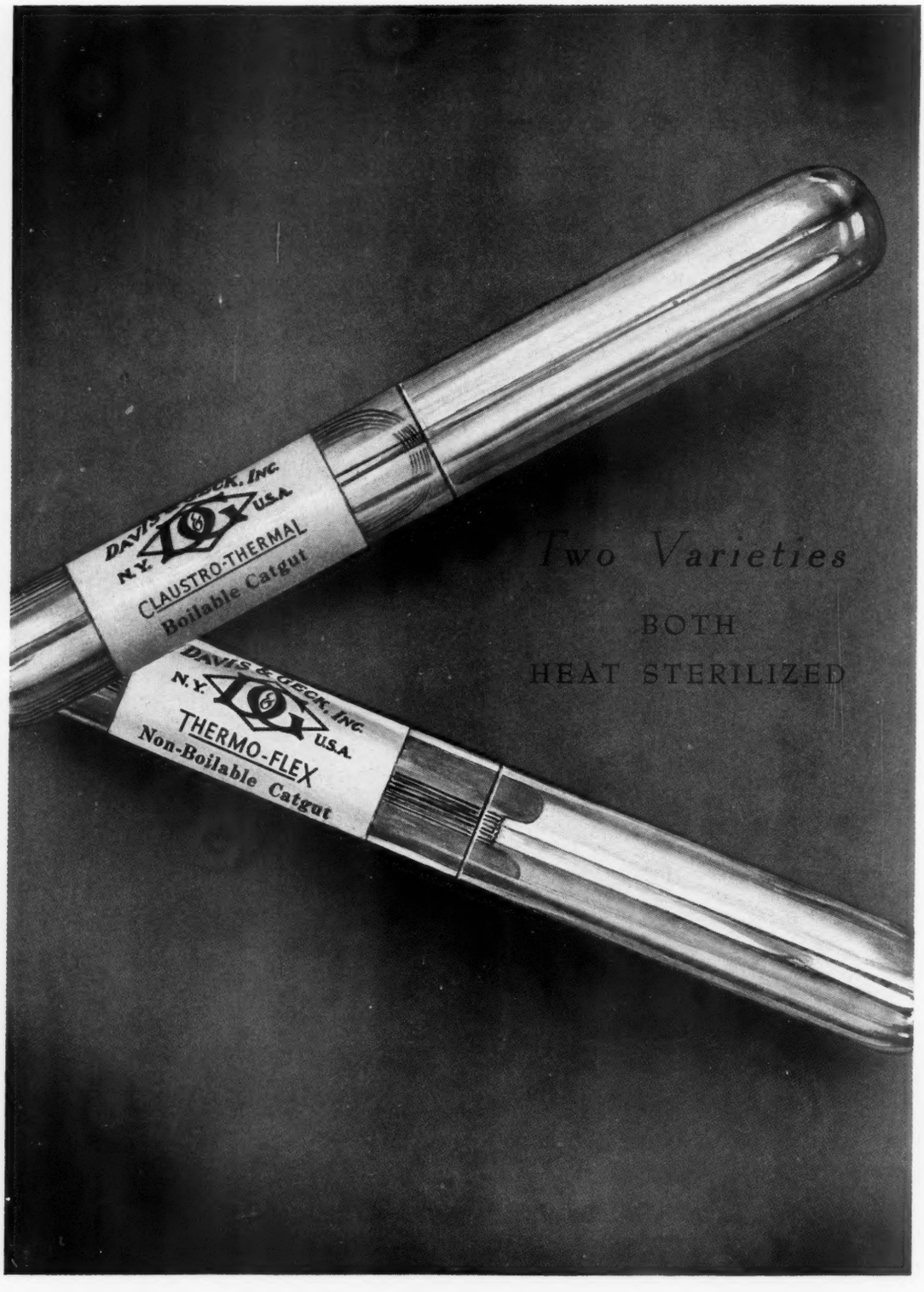
ANDREAS VESALIUS (1514-65). Though best known for his preeminence as an anatomist, Vesalius was also one of the greatest surgeons of his day. His diagnosis of abdominal aneurism and successful operation for empyema were outstanding contributions. Other clinical attainments and observations, recorded by a student and published posthumously, comprise seven volumes. One of these devotes a section to sutures and their use in the control of bleeding.

D&G Sutures

"THIS ONE THING WE DO"

DAVIS & GECK INC.

"THIS ONE THING WE DO"



SINCE 1909 — *Surgical Sutures Exclusively*

DAVIS & GECK SUTURES

Claustro-thermal Catgut

POSSESSES all the qualities essential to proper function and is adaptable to all conditions and technics. Tubes may be boiled or autoclaved or treated germicidally for asepticization of their outer surfaces.

This catgut offers the additional safety factor of CLAUSTRO-THERMAL* sterilization —an exclusive D&G process wherein heat, at temperatures lethal to the most resistant spores and organisms, is applied *after* the suture is hermetically sealed in its glass tube and thus fully protected.

Being completely stable the suture is unaffected by age, climate, light or by the reboiling or autoclaving of unused tubes. Its hydroscopicity makes flexibility easily regulated to meet individual preferences or specific requirements.

Thermo-flex Catgut

FLEXIBILITY is the feature of this catgut — the maximum flexibility practical without sacrifice of other equally essential characteristics. Ready for use as it comes from the tubes, it requires no moistening or special preparation.

Though of the non-boilable type, there is no compromise in sterility. It is sterilized by *heat* at temperatures exceeding the most rigid bacteriologic requirements.

Its moisture content is normal and therefore it lacks the tendency towards progressive deterioration in strength typical of water-logged catgut. It is unaffected by age, climate, or light.

D&G THERMO-FLEX* catgut represents that fine balance of qualities so vital to correct function and utmost dependability.

Fine-gauge Catgut

UNPRECEDENTED in its smallness of diameter this material is comparable in size to fine silk, yet it provides the distinct advantage of absorbability. Moreover, it may be used freely without special technics or sacrifice of operating time. Exceptional strength and resistance to absorption make it applicable to a wide range of procedures, facilitating accurate apposition and providing prolonged retention with marked reduction in trauma. Available in both boilable and non-boilable varieties.

DAVIS & GECK SUTURES WITH ATRAUMATIC NEEDLES FOR SPECIFIC PROCEDURES

Intestinal *Thyroid* *Tonsil* *Eye* *Harelip*
Cleft Palate *Plastic* *Nerve* *Artery* *Obstetrical*
Circumcision *Ureteral* *Renal*

A LIST OF SIZES, LENGTHS, SUTURE-NEEDLE COMBINATIONS AND PRICES WILL BE SENT ON REQUEST

* D&G Registered Trade Mark

The Rationale of Suture Use

BRIEF DISCUSSIONS BASED ON REPORTS OF CURRENT RESEARCH AND CLINICAL OBSERVATION

Suturing Accidental Wounds in Civil and War Surgery

TWO FACTORS determine whether accidental or traumatic wounds should be sutured. These are the duration of the bacterial contamination and the amount of contused tissue about the wound.

Bacteria begin to multiply and to invade the edges of a wound after seven to ten hours. Wounds seen before this interval may be sutured without drainage, but only after irrigation and debridement. When seen after this "safe period", wounds should not be sutured but should be left open and treated as if infected. Even partial suturing of the length of such wounds, with the hope of providing some drainage and partial approximation, is absolutely contraindicated. The sutures would act only as foreign bodies and would retard healing which, under the circumstances, must occur by secondary intention anyway. They would slough out or have to be removed later.

If the edges of a wound are too widely separated to approximate, its size may be reduced by accurately suturing the angles without tension—but again only after irrigation and debridement.

Sutures should not be placed in contused tissues because infection invariably results. Moreover, insertion of sutures causes further injury which may result in complete necrosis of partially injured cells. Instead, the contused tissue should be debrided.

Complete debridement of contused tissue is not always possible, however, in traumatic wounds. In some cases the wound may be only the split in widely contused tissue. Scalp wounds resulting from falls or from blows by very blunt objects are frequently of this nature. Removal of the necessary amount of contused tissue would produce a defect impossible to close. Therefore, for such a wound a debridement removing only the foreign bodies and an approximation of the edges with adhesive plaster seems more advisable.

Suturing is usually avoided in traumatic war wounds. The bacterial contamination is often overwhelming or virulent or the wounds are seen after the safe period has elapsed and contusion is usually so extensive that more lives are saved by employing the open method of treatment with plaster immobilization. Such wounds are sutured secondarily after Dakinization. Chemotherapy is an important adjunct. These methods may also be applied in civil practice for similar circumstances.

Discussions of eight subjects in this series on Suture Use have been published. Reprints (including the above) and a bibliography will be sent on request.

DAVIS & GECK, INC., *Brooklyn, N. Y.*

You serve with *Precision*
when you serve with the
BAUMANOMETER

Lifetime Baumanometer
STANDARD FOR BLOODPRESSURE

THE
KOMPAK
MODEL
Smallest • Lightest
Handiest
$29.50

You'll be pleased with its handsome finish . . . its simplicity of operation . . . its compactness—yet the most important feature of the Lifetime Baumanometer cannot be seen . . . *its scientific accuracy*. This essential accuracy is built into every Baumanometer.

All Baumanometers are true mercury-gravity instruments . . . scientifically accurate, and guaranteed to remain so. Lifetime Baumanometers do not depend upon the elasticity of metal for their indications.

Your dealer can supply you.

Get the Facts and you will buy a Lifetime Baumanometer

W. A. BAUM CO. Inc. NEW YORK
ORIGINATORS AND MAKERS OF BLOODPRESSURE APPARATUS EXCLUSIVELY

The American Journal of Surgery, Inc.

Reg. U. S. Pat. Off., Nov. 3, 1936

NEW SERIES VOL. LIV — NUMBER TWO

Contents • November, 1941

Editorial

Intractable Peptic Ulcers—Are They a Surgical or a Medical Problem? . *Albert F. R. Andresen* 339

Original Articles

Immediate Complications of Operations for Acquired Cataract. Certain Complications Affecting the Anterior and Posterior Segments of the Eyeball *Conrad Berens and Donald Bogart* 346

Prevention of Discomfort and Disability in the Treatment of Varicose Veins. . *I. A. Brunstein* 362

Congenital Discoid Meniscus. A Cause of Internal Derangement of the Knee *Edwin F. Cave and O. Sherwin Staples* 371

Chronic Sclerosing Osteomyelitis: Garré . . . . . *D. Rees Jensen* 377

General Considerations of Fistula-In-Ano. The Rôle of Foreign Bodies as Causative Factors . . . . . *Alfred M. Buda* 384

Contents Continued on Page 3

THE HELPING HAND

THE POSTOPERATIVE ROAD to recovery is frequently an uphill grade, beset with the pitfalls of gas pains, distention, ileus, and urinary retention. More and more surgeons are finding in Prostigmin the helping hand that aids the patient through a smoother convalescence. Routine use of Prostigmin Methylsulfate 1:4000 prevents postoperative distention and urinary retention by maintaining the tone of intestinal and bladder musculature. The recommended dosage schedule consists of an intramuscular injection of 1 cc (1 ampul) of the 1:4000 solution immediately after operation, followed by 5 similar 1-cc injections at 2-hour intervals. Additional injections may be given if necessary; by effects from the use of Prostigmin in therapeutic doses are conspicuously absent.

*PROSTIGMIN METHYLSULFATE 1:4000, 1 cc, boxes of 12 and 100 ampuls, blue label. For the prevention of postoperative distention.

PROSTIGMIN METHYLSULFATE 1:2000, 1 cc, boxes of 12 and 50 ampuls, buff label. For the treatment of postoperative distention and of myasthenia gravis.

†PROSTIGMIN BROMIDE Tablets, 15 mg., vials of 20. For the oral treatment of myasthenia gravis.

**Dimethylcarbamic ester of 3-hydroxyphenyl-trimethyl-ammonium methylsulfate.*

†*Dimethylcarbamic ester of 3-hydroxyphenyl-trimethyl-ammonium bromide.*

HOFFMANN-LA ROCHE, INC.
ROCHE PARK • NUTLEY • NEW JERSEY

PROSTIGMIN METHYLSULFATE 1:4000

The American Journal of Surgery

NEW SERIES VOL. LIV — NUMBER TWO

Contents · November, 1941

Right Lateral Rectus Incision in Acute Appendicitis . . . . . C. Grant Bain 388
Extrauterine Fibromyomas . . . . . G. D. Scott and Irvin H. Scott 391
Adenomyoma of the Stomach. Heterotopia of Brunner's Glands Producing Pyloric Obstruction. Case Report . . . . . Lyman W. Crossman and James H. Kidder 395
Obstetrical Analgesia in Private Patients . . . . . Bernard J. Hanley 403
Methylene Blue as an Indicator for the Oral Administration of Food to the Surgical Patient . . . . . Benj. I. Golden and J. E. Martin, Jr. 407
Tendon Injuries. A Study of One Hundred and Sixteen Cases . . . . . Donald H. Hooker and Conrad R. Lam 412
Leukocyte Exhaustion in Intestinal Obstruction . . . . . Franklin I. Harris and Captain Jean Spencer Feldheym 417
Malignant Argentaffine Tumors of the Appendix . . . . . Earl O. Latimer 424
Statistical Review of Carcinoma of the Stomach . . . George M. Saypol and J. William Hinton 431
Method to Prevent Fresh Costal Cartilage Grafts from Warping . . . . . Gordon B. New and John B. Erich 435
Surgical Technic for Removal of Solitary Destructive Neoplastic Lesions of the Cranium . . . . . James L. Poppen 439
Suppression of Lactation by Stilbestrol . . . . . Oscar H. Bloom 443

Case Reports

Segmental Abdominal Heterotaxy. Situs Inversus Viscerum Abdominis Partialis . . . . . Joseph I. Anton, Charles E. Panoff and Milton B. Spiegel 446
Sarcoma Developing in an Old Burn Scar . . . . Richard M. Fleming and Phillip R. Rezek 457
Marjolin's Ulcer. Report of a Case . . . . . Harold R. Browne 466
Riedel's Thyroiditis. A Review and Report of Two Cases . . . . . Henry I. Goodman 472
Exstrophy of Rectal Mucosa. . . . . Jerome M. Lynch and G. Johnson Hamilton 479
Pregnancy and Delivery with an Intrauterine Pessary in the Cervix . . . . . Thurston S. Welton and Oren Ellingson 484
Primary Ovarian Pregnancy. Case Report . . . . . Edwin Breck Eckerson 487
Sterilization of the Ovaries by Roentgen Rays in the Treatment of Distant Metastases from Primary Carcinoma of the Breast. Report of Two Cases . . . Ernst A. Pohle 490
Iliocolic Intussusception. Diagnosis by X-ray without Contrast Media . . . Joseph Levitin 494
Mental Disorders Associated with Hyperthyroidism . . . . . Elbert T. Rulison, Jr., John D. White and Leonard K. Stalker 499
Peritoneoscopy versus Exploratory Laparotomy. A Comparison of Morbidity and Mortality . . . . . Boardman M. Bosworth 502

New Instruments

Electric Bone Saw and Drill . . . . . J. Vernon Luck 505
Appendectomy with a Modified Furniss Clamp . . . . . Arthur Bowen 508
Doyen Tumor Screw. Furniss Modification . . . . . H. D. Furniss 510

Bookshelf Browsing

The Carnero. A Fish Parasite of Man and Possibly of Other Mammals . . . . . Kenneth W. Vinton and W. Hugh Stickler 511
Selected Book Review 520

Special Monograph

Cesarean Section. The Modern Operation . Charles A. Gordon and Alexander H. Rosenthal 525

General Information on Page 4 *Advertisers Index on 3rd Cover*

General Information

THE AMERICAN JOURNAL OF SURGERY does not hold itself responsible for any statements made or opinions expressed by any contributor in any article published in its columns.

Articles are accepted for publication with the understanding that they are original contributions never previously published. All manuscripts are subject to editorial modification, and upon acceptance become the property of THE AMERICAN JOURNAL OF SURGERY, INC.

A reasonable number of illustrations are supplied free of cost; special arrangements must be made with the editor and publishers for excess illustrations and elaborate tables.

Reprints are furnished on order. Prices are quoted when articles are in page form.

Material published in THE AMERICAN JOURNAL OF SURGERY is copyrighted and may not be reproduced without permission of the publishers.

Change of address must reach us by the 15th of the month preceding month of issue.

PREPARATION OF MANUSCRIPTS

Text. Manuscripts are to be typewritten, on one side of the paper, with double spacing and good margins. The original should be sent to the editor and a carbon copy retained by the author.

Illustrations. Illustrations must be in the form of glossy prints or drawings in black ink (*never* in blue). On the back of each illustration the figure number, author's name and an indication of the top of the picture should be given. Legends for illustrations are to be typewritten in a single list, with numbers corresponding to those on the photographs and drawings. Please do not attach legends to the pictures themselves.

Bibliographies. Bibliographic references should be at the end of the manuscript, in alphabetical order, and not in footnotes. Each reference should include the following information in the order indicated: Name of author with initials; title of article; name of periodical; volume, page and year. The following may be used as a model:

PHANEUF, LOUIS E. Indications and technique. *Am. J. Surg.*, 25: 446, 1937.

The author should always place his full address on his manuscript.

The subscription price of THE AMERICAN JOURNAL OF SURGERY, is $10.00 per year in advance in the United States; $15.00 in Canada; and $12.00 in foreign countries. Current single numbers $2.00. ALL SPECIAL NUMBERS $4.00. Prices for such back numbers as are available will be quoted on request.

Address all correspondence to

The American Journal of Surgery, Inc.

49 WEST 45TH STREET · NEW YORK

A Blackboard Demonstration of an unusual Service to Hospitals

WECK SERVICE to hospitals is summarized in a sentence on the blackboard above...

101,150 cases of efficiency

101,150 cases of economy

And these 101,150 cases* cover a wide and varied service to hospitals from coast to coast: NEW INSTRUMENTS made in the Weck plant by Weck's experienced craftsmen . . . Weck-repaired and Weck-reconditioned instruments saving hospitals thousands of dollars annually . . . ranging all the way from the replacement of a broken screw, to the sharpening anew of the dulled microtome knife blade ... but so EFFICIENTLY IS THIS DONE that Weck is able to GUARANTEE *one-week return of all repairs.*

In this drive for ECONOMY Weck has never lowered EFFICIENCY. For Weck pioneered the way with CRODON, The Chrome Plate of QUALITY. . . now Weck also offers STAINLESS STEEL where your surgeons prefer that finish.

The 101,150 cases* prove the wide acceptance of the Weck ECONOMY with EFFICIENCY idea in serving hospitals. For now hospitals in the 48 states order by mail, if they wish, from Weck with perfect CONFIDENCE that whatever their "case" or "problem" it will be solved in the EFFICIENT and ECONOMICAL manner by Weck. Fifty years plus of Weck service is final criterion of this claim.

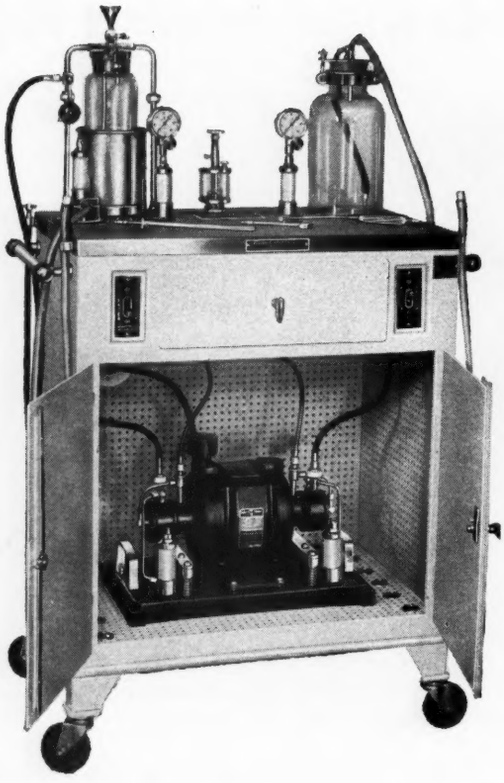
Therefore, whether it is NEW instruments, or the repair *and return in one-week,* of old; whether it is rubber tubing, or gloves, or sheeting; or a host of other hospital supplies, *check with Weck* for ECONOMY and EFFICIENCY *in every case.*

*By "cases" here we refer to the entered numbered orders in the Weck files. One order may cover few or many hundreds of dollars, and a large or small variety of items. It would reach an almost fantastic figure if we tried to use the total number of "items" sold the Weck-way since its founding over fifty years ago.

Founded 1890

WECK
CRODON
The Chrome Plate

Edward Weck & Co., Inc.
Manufacturers Surgical Instruments
SURGICAL INSTRUMENT REPAIRING • HOSPITAL SUPPLIES
135 Johnson Street Brooklyn, N.Y.



For Heavy Duty Hospital Work

Bellevue

Improved Hospital Model

SUCTION and PRESSURE UNIT

THE Bellevue Suction and Anaesthesia Apparatus was designed for continuous operation under the conditions imposed by heavy duty hospital work.

The motor unit is the new spring suspended type which completely absorbs all vibration and eliminates noise. The two rotary compressors, one for negative and the other for positive pressures, are connected direct to the shaft of the powerful slow speed, noiseless motor. There are no springs or ball valves to become clogged, or get out of adjustment; no belt to slip, stretch or break.

It has a central unit automatic lubrication system. A single push of the oil plunger, after every 5 hours of operation, sends oil to all parts where lubrication is required. Lubrication is practically the only attention required.

The Bellevue is now equipped with a one gallon size suction bottle. The ether supply has a double heating device, and both ether and vacuum lines are equipped with perfect filter systems. The pressure and vacuum gauges and regulating valves are on top of cabinet, easy of access. All features of the Bellevue are highly perfected. Entire unit is fireproof and explosionproof.

Price for unit operating on 110-120 volt, 60 cycle **$345.00**

For other voltage or cycle, small additional charge.

Send for Descriptive Folder. *Sold Only Through Surgical Supply Dealers.*

J. SKLAR MANUFACTURING COMPANY

38-04 WOODSIDE AVE. LONG ISLAND CITY, N. Y.

NOW AVAILABLE
STILBESTROL
SQUIBB

STILBESTROL was described and named in 1938 by Dodds, Golberg, Lawson and Robinson[1] who reported that it was "by far the most potent" of the many synthetic estrogens investigated. Since that time the product has undergone extensive clinical trial and more than one hundred papers have been published reporting its uses and advantages. Stilbestrol Squibb was used in a large number of these studies.

Stilbestrol Squibb (alpha, alpha'-diethyl-4, 4'-stilbenediol) is a synthetic estrogen for replacement therapy in deficiency of the estrogenic hormone. In contrast to the natural estrogens it is only slightly less effective orally than intramuscularly. Stilbestrol is also much more economical to use and therefore its field of usefulness is greatly enlarged.

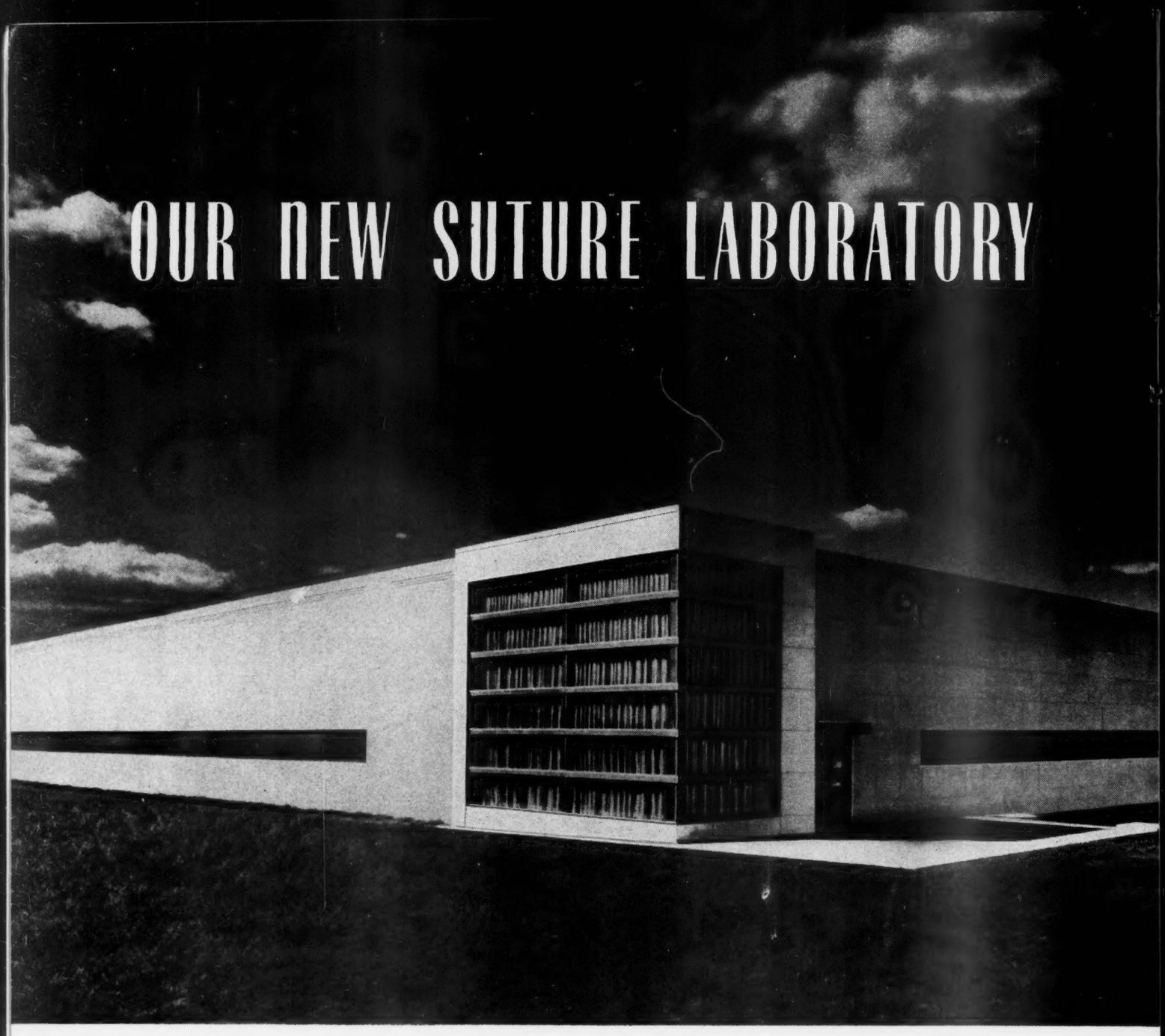
The use of Stilbestrol has been established in alleviating vasomotor symptoms of the menopause (both natural and surgical); gonorrheal vaginitis in children; senile vaginitis and kraurosis vulvae and pruritis vulvae of the menopause. It may be administered orally, hypodermically, or intravaginally. Dosage and route of administration vary with the condition being treated and with the individual patient. In common with other highly potent chemotherapeutic agents, Stilbestrol should be used with caution and only under the immediate supervision of the physican.

[1] Dodds, E. C.; Golberg, L.; Lawson, W.; and Robinson, R.: *Nature* 141:247, 1938.

How Supplied: Stilbestrol Squibb is supplied in three forms:
COMPRESSED TABLETS, either uncoated or enteric-coated (*for oral administration*) containing 0.1 mg., 0.5 mg., 1.0 mg., 5.0 mg. in bottles of 25, 100 and 250.
AMPULS (*for intramuscular injection*) in 1-cc. ampuls containing 0.2 mg., 0.5 mg., 1.0 mg. and 5.0 mg. per 1 cc. respectively, in boxes of 6, 25 and 50.
PESSARIES (*for vaginal medication*) in two sizes. 0.1 mg. for children and 0.5 mg. for adults, both in boxes of 12 and 50.

For literature write Professional Service Dept., 745 Fifth Ave., New York

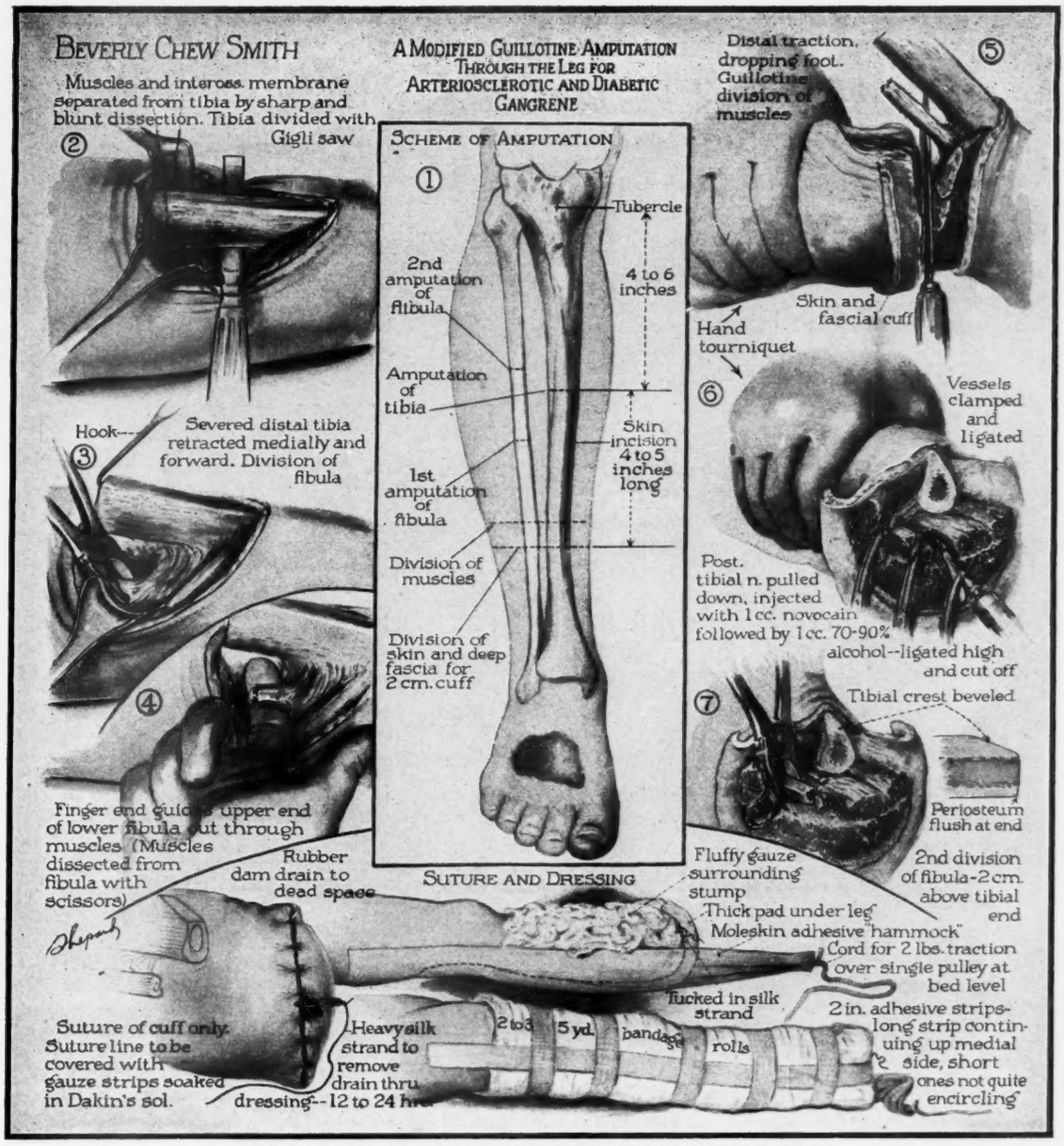
E·R·SQUIBB & SONS, NEW YORK
MANUFACTURING CHEMISTS TO THE MEDICAL PROFESSION SINCE 1858.



Devoted to the tubing and sterilizing of Ethicon Sutures

Johnson & Johnson has greatly expanded its facilities for the production of Ethicon Surgical Gut, with new buildings in New Brunswick and Chicago. The picture above shows the New Brunswick Suture Laboratory, a modern, completely air-conditioned structure in which the sutures are processed under ideal conditions. All Ethicon Sutures, of course, conform strictly to U. S. P. Standards.

ETHICON SUTURES


BEVERLY CHEW SMITH
A MODIFIED GUILLOTINE AMPUTATION THROUGH THE LEG FOR ARTERIOSCLEROTIC AND DIABETIC GANGRENE
Muscles and inteross. membrane separated from tibia by sharp and blunt dissection. Tibia divided with Gigli saw
SCHEME OF AMPUTATION
Tubercle
2nd amputation of fibula
4 to 6 inches
Amputation of tibia
Skin incision 4 to 5 inches long
1st amputation of fibula
Division of muscles
Division of skin and deep fascia for 2 cm. cuff
Distal traction, dropping foot. Guillotine division of muscles
Skin and fascial cuff
Hand tourniquet
Hook
Severed distal tibia retracted medially and forward. Division of fibula
Vessels clamped and ligated
Post. tibial n. pulled down, injected with 1 cc. novocain followed by 1 cc. 70-90% alcohol--ligated high and cut off
Tibial crest beveled
Periosteum flush at end
Finger end guides upper end of lower fibula out through muscles (Muscles dissected from fibula with scissors)
Rubber dam drain to dead space
2nd division of fibula-2 cm. above tibial end
SUTURE AND DRESSING
Fluffy gauze surrounding stump
Thick pad under leg
Moleskin adhesive "hammock"
Cord for 2 lbs. traction over single pulley at bed level
Tucked in silk strand
2 in. adhesive strips-long strip continuing up medial side, short ones not quite encircling
Suture of cuff only. Suture line to be covered with gauze strips soaked in Dakin's sol.
Heavy silk strand to remove drain thru dressing--12 to 24 hrs.
2 to 3
5 yd.
bandage
rolls

OPERATIVE PROCEDURE—PLATE NO. 123—COPYRIGHT 1941, JOHNSON & JOHNSON

A Modified Guillotine Amputation

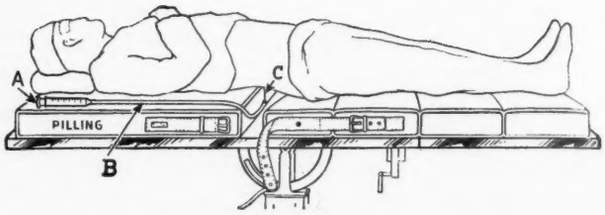
Absolute sterilization by heat, without impairment of tensile strength, is the daily production standard of Ethicon Sutures. As taken from the sterile tubes, they possess more tensile strength than is required to ligate the largest human blood vessel or to suture the densest human tissue. Ethicon Sutures are produced by exclusive procedures, from the raw material to the final stage of packaging and inspection in our laboratories.

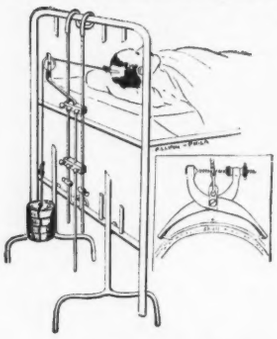
SUTURE MAKERS Johnson & Johnson SINCE 1887
NEW BRUNSWICK, N. J. CHICAGO, ILL.

PILLING INSTRUMENTS

LEMMON EQUIPMENT FOR CONTINUOUS SPINAL ANESTHESIA

Used by Wm. T. Lemmon, M.D., Jefferson Hospital, Philadelphia, in a large variety of over 1100 operations. Can be used on any operating table. Interesting reprint describing the technique and equipment sent on request. **See American Journal of Surgery, Sept., 1941.**





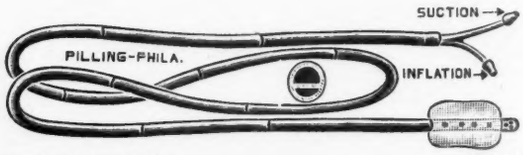
CRUTCHFIELD SKULL TONGS

W. Gayle Crutchfield, M.D., Dept. of Neurological Surgery, Medical College of Virginia, Richmond, Virginia.

P16605 Crutchfield Tong Set for fracture dislocations of the cervical spine; complete set of tongs (rustless steel), geared drill and two drill points **$30.00**

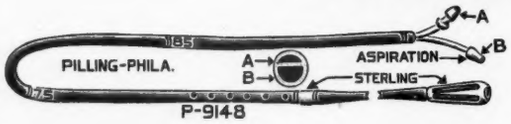
Reprint and technique on request.

MILLER-ABBOTT DOUBLE LUMEN TUBE



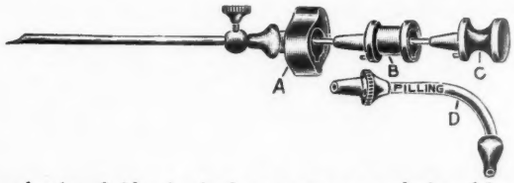
P9140 Miller-Abbott double lumen tube for small intestinal intubation **$7.50**
Descriptive 12-page pamphlet with technique and bibliography sent on request.

ABBOTT-RAWSON DOUBLE BARRELLED GASTRO-ENTEROSTOMY TUBE



"Double Barrelled Gastro-Enterostomy Tubes (Abbott-Rawson) P9148 is designed for the post-operative care of malnourished patients subjected to any form of operative procedure anastomosing the stomach to the small intestine. See Journal of the American Medical Association, June 10, 1939. ANNALS OF SURGERY, October 1940. Price **$6.50**

TOCANTINS SET FOR INFUSION VIA THE BONE MARROW



P17225 Tocantins re-designed Set for Blood Infusion and other fluids via the bone marrow, as designed by L. M. Tocantins, M.D., Jefferson Hospital, Philadelphia. Each Set, A, B, C and D, made in three lengths; short, medium and long. Send for descriptive circular and bibliography.

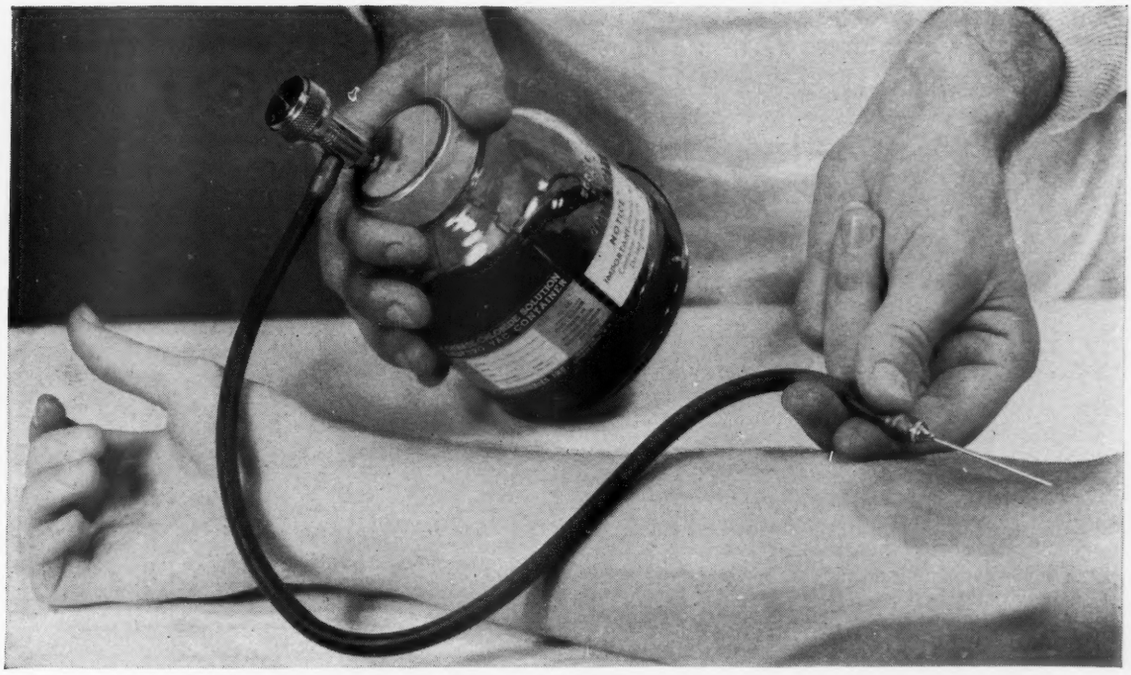
P17220—Tocantins Set (Length of A, 1.5 cm.), A, B, C, D ..... **$ 5.00**
P17221—Same (Length of A, 2.5 cm.), A, B, C, D **5.00**
P17222—Same (Length of A, 4 cm.), A, B, C, D **5.00**
P17225—Set of 3 lengths, 1.5 cm., 2.5 cm., and 4 cm., each including A, B, C, D and 2 Pilling Luer, P9364, 5 cc. syringes **18.00**

See "Surgery, Gynecology and Obstetrics," Sept., 1941: pages 279 to 287

MADE AND SOLD BY
THE GEORGE P. PILLING & SON COMPANY
Arch & Twenty-third Sts. Philadelphia, Pa., U. S. A.

PRODUCTS OF BAXTER LABORATORIES

BAXTER TRANSFUSO-VAC



. . . a safe, completely closed technique—with dependable vacuum

The Baxter Transfuso-Vac container and accessories are *all that are needed* for drawing, citrating, transporting, storing, filtering and infusing. *One operator can handle entire technique unassisted.*

The Transfuso-Vac has a mechanically induced vacuum—which gives *positive assurance* that transfusion will not be interrupted by low vacuum and that blood will remain sealed under vacuum.

The exclusive precision Transfuso-Valve accurately controls flow, preserves vacuum and prevents contamination—extremely important in phlebotomy, *but indispensable in aspirating serum and plasma.* Another important and exclusive Baxter accessory is the Filterdrip with its stainless steel mesh, which filters every drop of blood and prevents clots from passing through tubing.

PRODUCTS OF
BAXTER LABORATORIES
GLENVIEW, ILLINOIS; COLLEGE POINT, NEW YORK; ACTON, ONTARIO; LONDON, ENGLAND
PRODUCED AND DISTRIBUTED IN THE ELEVEN WESTERN STATES BY DON BAXTER, INC., GLENDALE, CALIFORNIA
★DISTRIBUTED EAST OF ROCKIES BY
AMERICAN HOSPITAL SUPPLY CORPORATION
CHICAGO NEW YORK

For prophylaxis in colonic surgery . . .

SULFAGUANIDINE

Lederle

THE LIMITED ABSORPTION OF SULFAGUANIDINE from the gastro-intestinal tract and its bacteriostatic effect on gram negative organisms have suggested its use as a pre-operative and post-operative prophylactic measure in colonic surgery. The successful oral use of this new sulfonamide in preventing infection following colonic resection has been reported*. It is believed that more extensive clinical investigation now under way will undoubtedly serve to evaluate further the usefulness of the drug as an adjuvant to abdominal surgery.

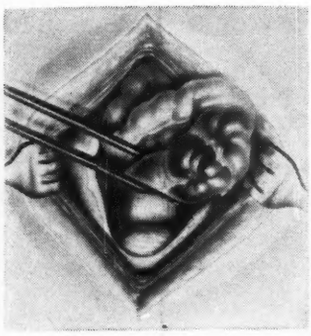
Booklet on request.

PACKAGES:

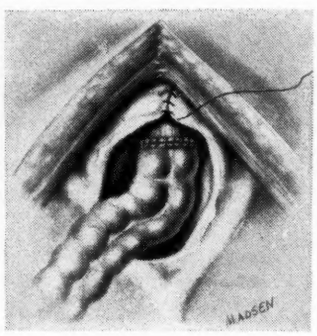
"Sulfaguanidine *Lederle*"

50 tablets, 0.5 gram (7.7 grains) each
100 tablets, 0.5 gram (7.7 grains) each
1000 tablets, 0.5 gram (7.7 grains) each
¼ pound, powder
1 pound, powder
12 packets, 3½ grams powder each, for oral use.

*FIROR, W. M. and JONAS, A. F., Ann. of Surgery, 114:19 (July) 1941.



A. Resection of sigmoid colon.



B. Primary anastomosis.

Prophylactic administration of Sulfaguanidine prior to surgery of the colon reduces the incidence of post-operative bacterial infection.

LEDERLE LABORATORIES, INC.
30 ROCKEFELLER PLAZA NEW YORK, N. Y.

Treatment of disease, to a great extent, is built on confidence. The patient believes in the competence of his physician, and the doctor, in turn, relies upon the company whose products he prescribes.

ENSEALS
(Enteric-Sealed Tablets, Lilly)
STILBESTROL
(Diethyl-stilbestrol)

Stilbestrol, a new crystalline synthetic estrogen, is of particular value in relieving symptoms of the menopause and in treating senile and gonorrheal vaginitis. Stilbestrol also may relieve or prevent painful engorgement of the breasts during suppression of lactation.

Stilbestrol is fully effective when administered orally and when given as 'Enseals' Stilbestrol rarely causes gastro-intestinal side-effects.

Supplied in 'Enseals,' Tablets, Ampoules, and Suppositories. Comprehensive literature is available to physicians.

ELI LILLY AND COMPANY

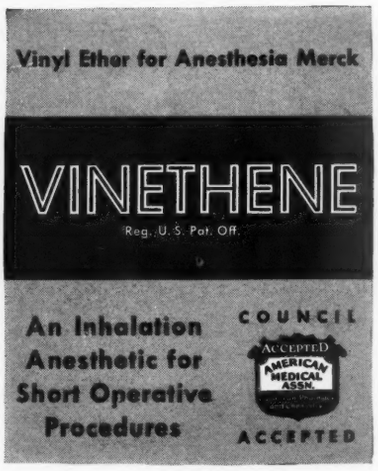
PRINCIPAL OFFICES AND LABORATORIES, INDIANAPOLIS, INDIANA, U. S. A.

FOR SHORT ANESTHESIAS IN THE HOME • OFFICE • OR HOSPITAL

In Vinethene, physicians have at their command an inhalation anesthetic, which is admirably adapted to short operative procedures in the home, office, or hospital. Vinethene anesthesia is characterized by: Rapid Induction. Adequate Relaxation. Prompt, Quiet Recovery. Infrequent Nausea and Vomiting.

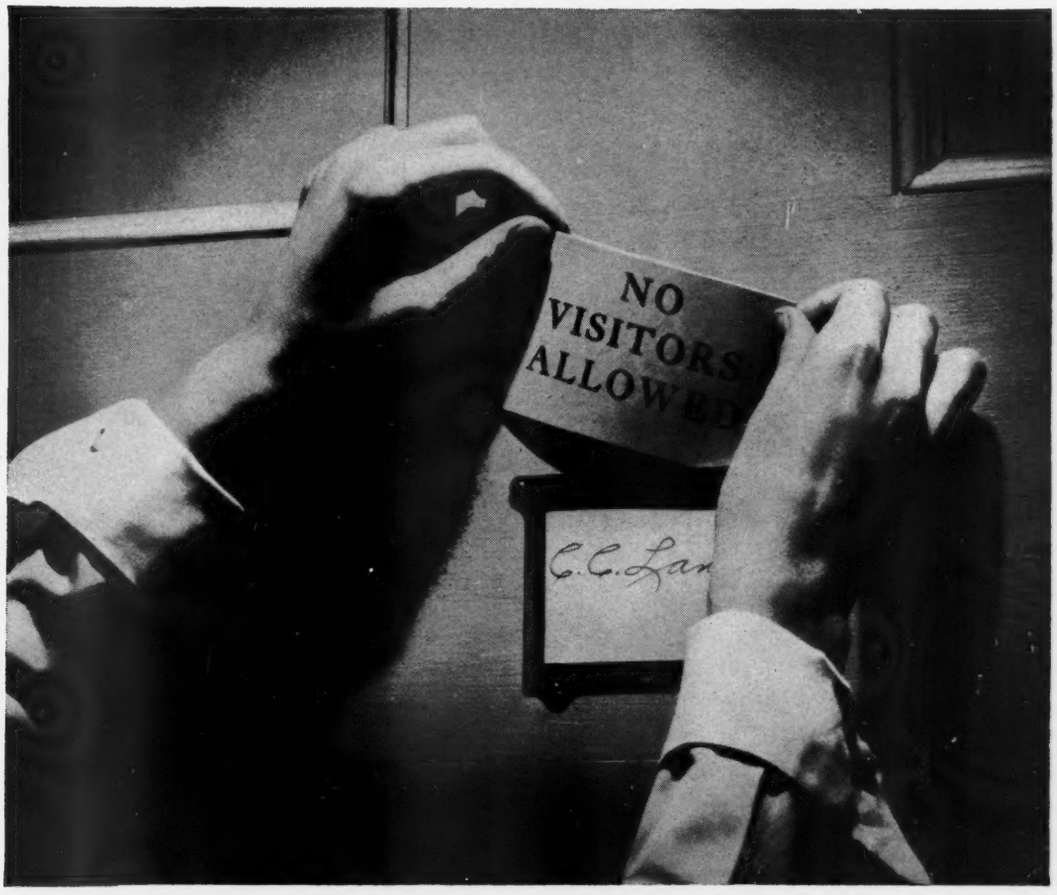
VINETHENE ***has been found of special value for:***

REDUCTION OF FRACTURES · MANIPULATION OF JOINTS · DILATION AND CURETTAGE MYRINGOTOMY · REPAIR OF PERINEAL LACERATIONS AND OTHER SHORT OBSTETRIC PROCEDURES · CHANGING OF PAINFUL DRESSINGS · INCISION AND DRAINAGE OF ABSCESSES · TONSILLECTOMY · EXTRACTION OF TEETH



MERCK & CO. Inc. *Manufacturing Chemists* **RAHWAY, N. J.**

"SEE YOUR DOCTOR." **Reproduced below is Number 171 of a series of full-page advertisements published by Parke, Davis & Co. in the interest of the medical profession. This "See Your Doctor" campaign has been running in *The Saturday Evening Post* and other leading magazines for thirteen years.**



The man who nearly died . . . from a few kind words

BEYOND THAT DOOR lies a very sick man. True, his doctor says he is going to pull through. But he has come mighty close to paying a tragic price for a few words of free advice from a well-meaning friend.

When he complained of a nagging pain in his abdomen, his friend said: "You've probably eaten something that's poisoned you. Here's what *I'd* do . . ."

So he promptly followed his friend's suggestion and took a cathartic. And in a matter of hours he was being rushed by ambulance to the hospital . . . with a ruptured appendix.

His friend, of course, had acted from the kindest of motives. But he didn't know that an abdominal pain might mean acute appendicitis, in which case a cathartic should never be taken.

Unfortunately, appendicitis is only one of many illnesses where amateur medical advice can result in tragedy. Yet, human nature being what it is, many people just can't resist the temptation to offer advice when a friend is sick.

Intelligent medical treatment depends upon various factors which only a physician is qualified to evaluate. When something seems wrong with you, it is the part of wisdom to observe this common-sense rule: Take a friend's advice about buying a radio, a car, or even a home if you wish; but don't let him advise you about your health.

Don't let a friend who *means* well tell you how to *get* well. To get well, and *keep* well, the man to see is your physician.

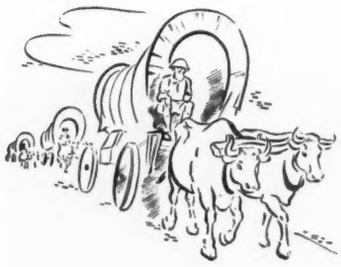
Copyright, 1941, Parke, Davis & Co.

PARKE, DAVIS & COMPANY
Detroit, Michigan
Seventy-five years of service to medicine and pharmacy

SEE YOUR DOCTOR

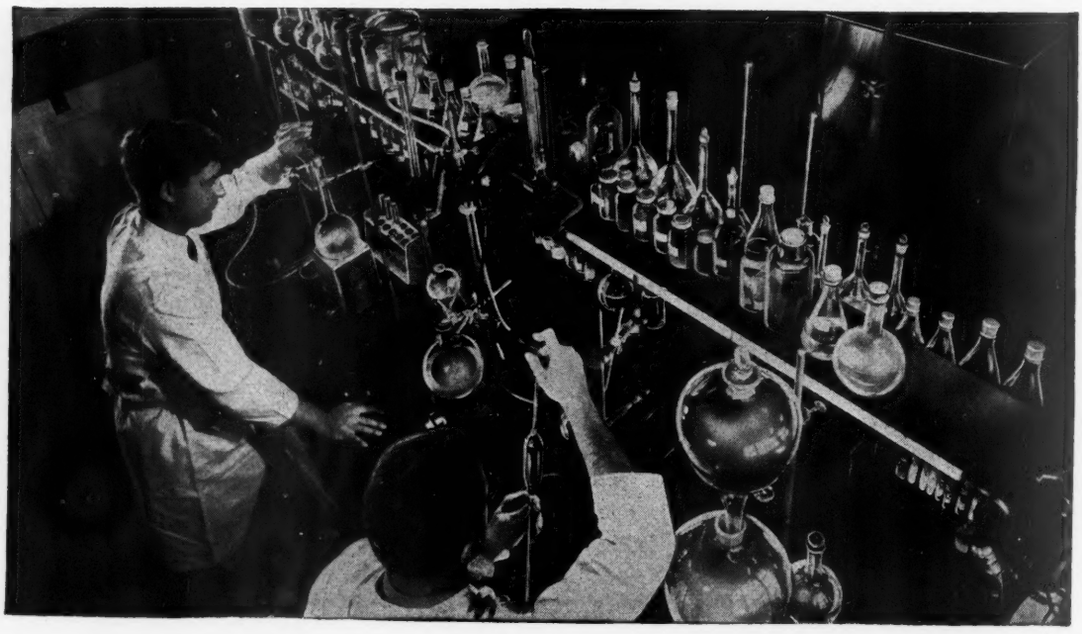
SEEKING NEW FRONTIERS

Within Four Walls . . . . .



The four walls of the laboratory do not a prison make for the vision of the inspired worker in search for new frontiers in medical progress. From his retorts and crucibles issue new ways and hitherto unknown measures for the alleviation of disease and for its prevention. To the earnest search for new and improved medicinal substances the Warner Institute for Therapeutic Research is dedicated. The results of its exploration in the field of purely scientific research are presented in the reports published from time to time. To make available its discoveries in therapeutic products to the physician and pharmacist, is the privilege of William R. Warner & Co., Inc., a world-wide organization, with laboratories and agencies in 75 countries.

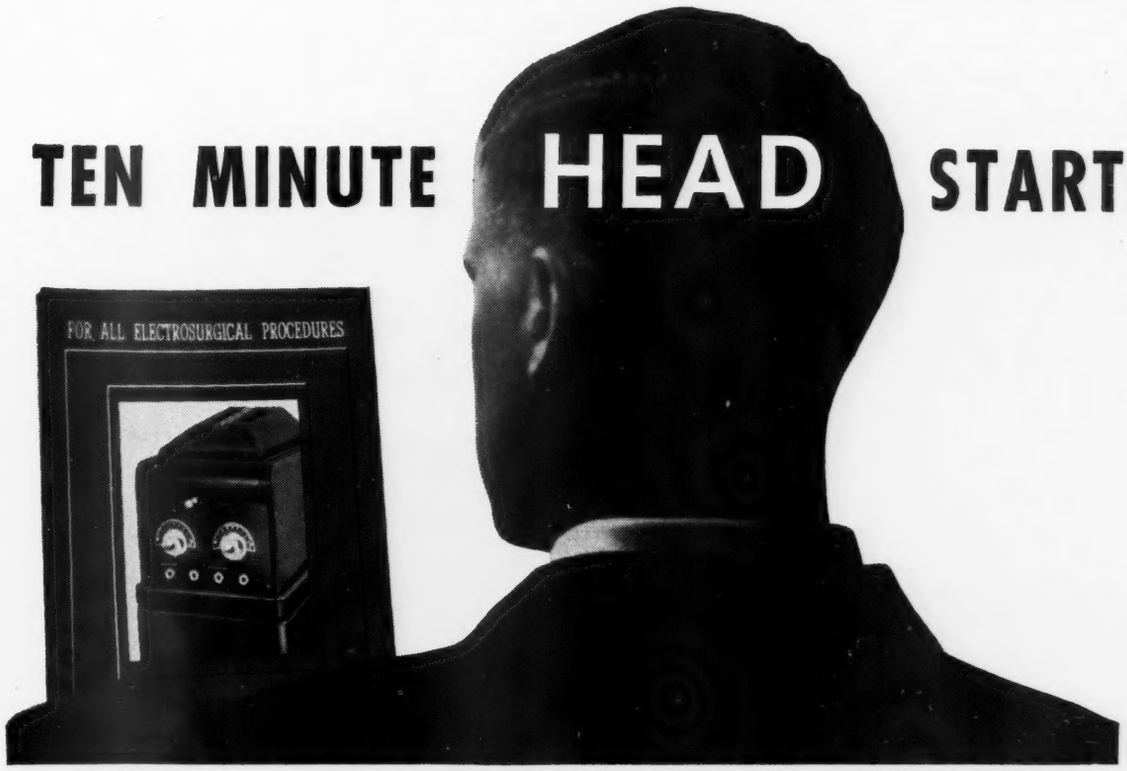
In the chemical research laboratory, a quick eye and expert fingers measure the quantities of solutions in fractions of drops.



113 West 18th Street, New York, N. Y. • 404 South 4th Street, St. Louis, Mo.

WILLIAM R. WARNER & CO., INC.

TEN MINUTE HEAD START



On a lifetime of electrosurgery's benefits

For modern electrosurgery's well-known, wide-range usefulness, General Electric offers the all-purpose Model "C" Unit. Full details of why this unit is widely favored by surgeons for its smooth, powerful cutting and coagulating currents are contained in a *free*, illustrated booklet (reading time 10 minutes). In these pages, you will learn how and why those currents are delivered under positive, convenient control. Here, too, you will come to appreciate, during 10 minutes, how a lifetime of operating dependability, of ample reserve power, and of provision for removal of all parts requiring sterilization is assured with the Model "C".

Yes, a lifetime is a long, long time and eyebrows often rise at its mention. But, General Electric stands back of its Model "C" to render that same ever-present service with which it protects every user of its products.

In view of the small investment, actually only 10 minutes, avail yourself of this opportunity to learn the value of the Model "C" Unit's place in your work. Clip the coupon, fill in and mail it, today

FREE

Please send me your *free*, illustrated booklet which explains how the G-E Model "C" Electrosurgical Unit can be my valuable assistant.

Name_____

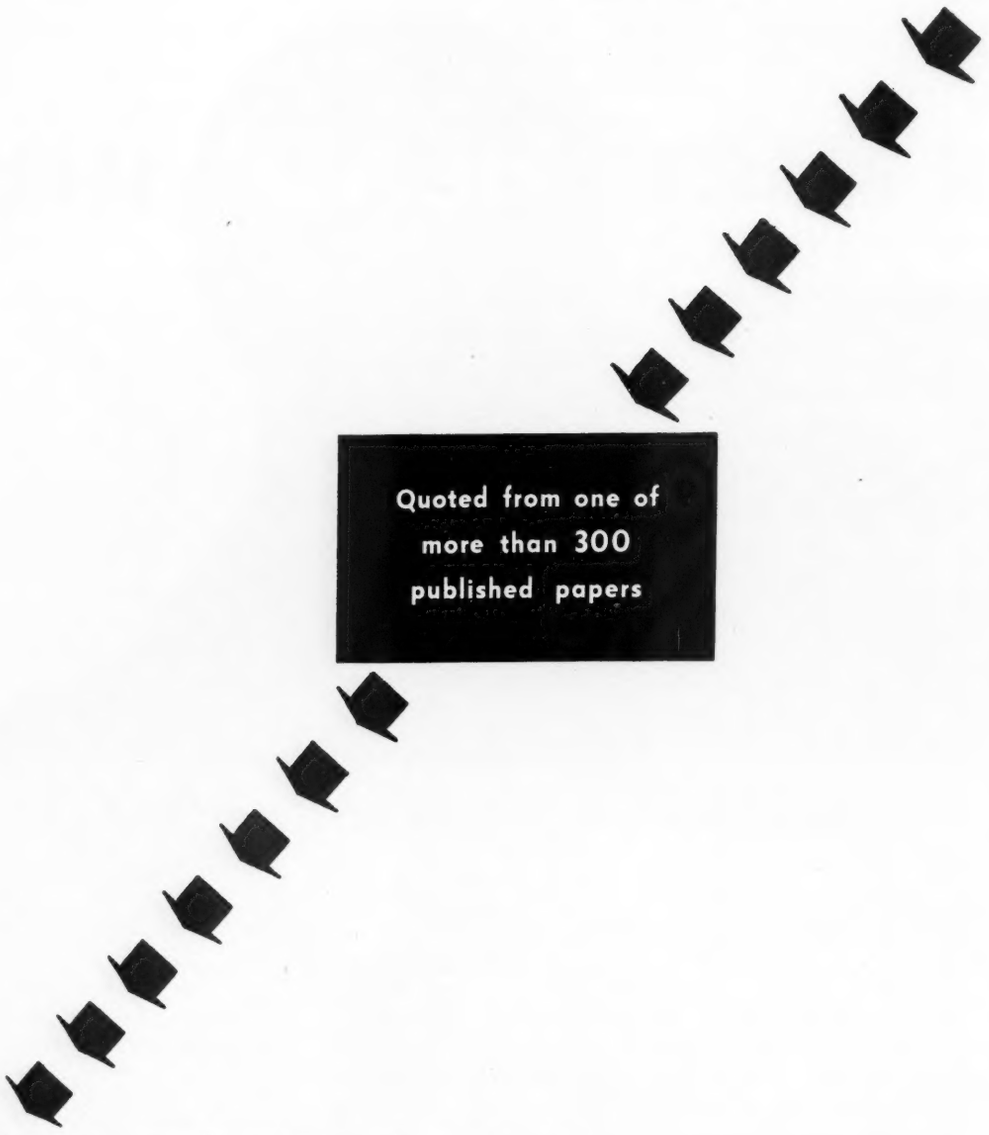
Address_____

City_____

E-211

GENERAL ELECTRIC X-RAY CORPORATION

2012 JACKSON BLVD. CHICAGO, ILL., U. S. A.



"After several years of constant use I most certainly believe that sodium ethyl thiobarbiturate*, when administered by a trained anesthetist, is one of the most satisfactory anesthetic agents that we have employed."

Palmer, E. Payne (1939) Southern Med. J., 32:290

Descriptive literature will be sent upon request. Address inquiries to Abbott Laboratories, North Chicago, Illinois

***PENTOTHAL SODIUM**
REG. U. S. PAT. OFF.

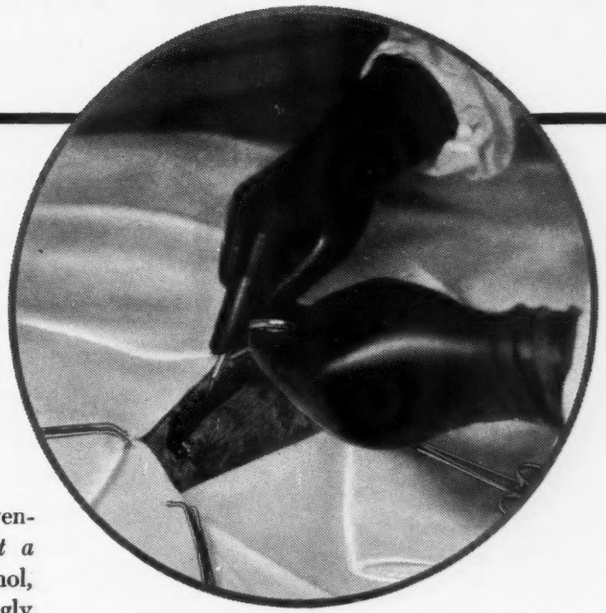
[Sodium Ethyl (1-Methyl-Butyl) Thiobarbiturate, Abbott]

For Intravenous Anesthesia

Zephiran...

Trade Mark Reg. U. S. Pat. Off. Brand of Benzyl-Trialkonium Chloride

NOT A MERCURIAL



A new type of germicide combining the best features of all types

ZEPHIRAN differs from the conventional antiseptics in that *it is not a mercurial,* does not contain phenol, iodine, or any metals, and is accordingly free from their disadvantages.

A mixture of high molecular alkyl-dimethyl-benzyl-ammonium chlorides, ZEPHIRAN couples bacteriologic potency with such an unusual combination of properties that many large hospitals have now adopted it as the routine preoperative antiseptic for skin and mucous membranes.

An active detergent. A ZEPHIRAN scrubbing emulsifies skin fats, loosens and rolls off dirt and dead skin cells so that it exposes the underlying skin and bacteria more completely to its germicidal action.

A wetting penetrating agent. ZEPHIRAN does not merely coat the skin; its low surface tension permits it to penetrate the interstices and pores.

A Soothing emollient. ZEPHIRAN soothes, softens and leaves the skin free from irritation or chapping. In 2,000 applications as a preoperative disinfectant, not a single case of skin or tissue irritation developed.

For Preoperative Skin and Mucous Membrane Disinfection . . . Eye, Nose and Throat Antisepsis . . . Wet Dressings and Irrigations . . . Bladder Lavages . . . Fungous and Bacterial Infections . . . Vaginal and Urethral Irrigations . . . Surgeons' Hand and Arm Soak.

Samples and Literature Sent Free on Request

TINTED TINCTURE 1:1000, STAINLESS TINCTURE 1:1000, AQUEOUS SOLUTION 1:1000, 8 OZ. AND 1 GAL. BOTTLES

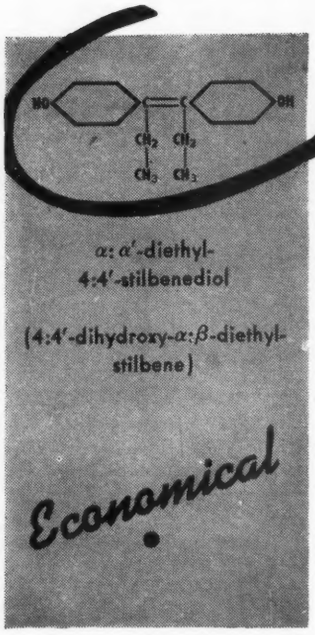
ALBA PHARMACEUTICAL COMPANY, INC., NEW YORK, N. Y.

NEW ESTROGENIC SUBSTANCE EFFECTIVE ORALLY

Stilbestrol

WINTHROP

(DIETHYLSTILBESTROL*)



CRYSTALLINE SYNTHETIC ESTROGEN

The new synthetic estrogen, Stilbestrol, now made generally available for the first time, has proved effective when given by mouth as well as by injection. A long awaited advancement is thus realized in an important field of hormone therapy. Moreover, Stilbestrol is much more economical to use than synthetic natural estrogens or extracts from animal sources.

INDICATIONS: Stilbestrol is indicated wherever an estrogenic effect is desired. It has been found of particular value in relieving the symptoms of the menopause, in senile vaginitis, and in gonorrheal vaginitis in children. It will relieve or prevent painful engorgement of the breasts during suppression of lactation.

HOW SUPPLIED

Tablets, 0.1 mg., 0.5 mg. and 1 mg., in bottles of 50, 250 and 1000.

Suppositories, 0.1 mg. and 0.5 mg., in boxes of 5 suppositories.

Ampules (Stilbestrol in Oil), 0.5 mg. in 1 cc., and 1 mg. in 1 cc., each in boxes of 5, 25 and 100 ampules.

Doctor: Write for a copy of Winthrop's booklet giving the essential details regarding this new therapeutic agent: Chemical and pharmacologic data, review of clinical reports, discussion of contraindications, side effects, methods of administration and dosage table.

*The Council on Pharmacy and Chemistry of the American Medical Association has recently adopted the name "Diethylstilbestrol" as the common nonproprietary designation.

WINTHROP CHEMICAL COMPANY, INC.

Pharmaceuticals of merit for the physician

NEW YORK, N. Y. **WINDSOR, ONT.**

819aM

The American Journal of Surgery

Copyright, 1941 by The American Journal of Surgery, Inc.

A PRACTICAL JOURNAL BUILT ON MERIT

NEW SERIES VOL. LIV NOVEMBER, 1941 NUMBER TWO

Editorial

INTRACTABLE PEPTIC ULCERS—ARE THEY A SURGICAL OR A MEDICAL PROBLEM?*

IN any discussion of the treatment of peptic ulcer, there always arises the question of what is to be done with the patient who does not get relief from the usual treatment or the one who gets repeated attacks of ulcer symptoms in spite of careful dieting. In the many reports of the results of treatment for ulcer, in which the percentage of "cure" by medical treatment is estimated usually at from 70 to 80 per cent, it is assumed that the other 20 to 30 per cent of cases are "intractable ulcers," for which surgical treatment is indicated. Surgeons, finding that results of the older types of operation in these cases have not been reasonably successful, have become more and more radical in their operative procedures, until now subtotal gastrectomy is unblushingly recommended for even uncomplicated duodenal ulcers. Pharmaceutical houses, seeing here a fertile field for newer forms of medication, have outdone each other in producing preparations which will *cure* even intractable ulcers. The result is that now we have a very imposing array of drugs for oral and parenteral use, each of which can be tried in turn in any stubborn case, and credit for a cure is given to the one which happens to be administered at the time symptoms may subside spontaneously. The fruitless and often acrimonious discussions of the treatment of ulcer by adherents of the different forms of therapy, which have made this subject taboo at polite medical meetings, should be considered an indication that no treatment by medicinal preparations is uniformly successful and that usually no treatment of the ulcer itself is required unless rest and frequent feedings of bland food have failed to relieve symptoms and repeated gastrointestinal studies have shown persistence of ulcer findings. There is at present no criterion of "intractability" in ulcer. Whether the term is to be used to describe the cases in which prompt relief of symptoms is not obtained by the usual dietetic or medicinal measures, whether it shall refer only to an unusually long period of symptoms before the patient has been put on an ulcer régime or whether unusually frequent recurrences of ulcer symptoms shall be the criterion, has never been established. Any one of these situations has in the past been deemed a sufficient reason for radical operative procedures, often to the detriment of the patient and to the chagrin of the surgeon.

* From the Gastroenterological Service, Long Island College Hospital. Read before the Section on Gastroenterology and Proctology, Meeting of the A. M. A., June 6, 1941.

In order to establish a satisfactory treatment for an intractable ulcer it is necessary to know the reasons for the intractability; and in order to understand why some ulcers are intractable, it is well to review briefly what is known about the etiology and course of peptic ulcer. Confronted by a constantly increasing array of reports of work being done in the experimental production of ulcers in animals and of their prevention or cure by various measures, with their apparent applicability to human ulcers, the clinician is led to believe that the production of ulcer is largely the result of acid erosion of the gastric or duodenal mucosa and that treatment directed to alkalinization is absolutely necessary for healing. And yet how contrary to fact and experience is this conception of ulcer. In the early days of experimental production of ulcers, before extensive mechanical procedures were instituted which undoubtedly have often interfered with healing, it was held that ulcers in animals were not like human ulcers, because they healed spontaneously with such rapidity. In the human, on the other hand, it has long been insisted upon that a diagnosis can almost certainly be made from the typical history of recurrent attacks of ulcer symptoms, with intervals of freedom from symptoms, and each attack self-limiting, even though the patient has seen no physician, has not suspected that he has had an ulcer and has gone through his attacks with no treatment at all unless he has discovered that temporary relief of symptoms could be obtained from food or alkali. From such a history one must be led to believe that ulcers either heal or become temporarily quiescent without treatment and in the presence of acid gastric juice. Repeated roentgenologic and gastroscopic observations of ulcers in patients who have received no treatment at all or at least no anti-acid treatment, have demonstrated the complete and rapid healing of ulcers while they were being bathed in highly acid gastric juice. It has long been my opinion that the gastric juice, by keeping the ulcer surface clean and perhaps slightly irritated, may actually promote healing. My experience of thirty years in the treatment of ulcer without any attempt at acid neutralization has shown just as good if not better results than in those cases in which some such anti-acid treatment has been used. After all, it is safe to assume that an uncomplicated ulcer will heal spontaneously if given a chance and that treatment must be directed to relieving the patient of hunger pains by frequent feedings of bland food while the ulcer is healing.

But what about the etiology of peptic ulcer? In spite of many experimental observations, one finds most authors stating that the cause of ulcer is not known. Although Rosenow[1] twenty-eight years ago demonstrated the relationship between peptic ulcers and focal infections, and although clinical experience in the thorough eradication of all focal infections has shown that only by this procedure can one be reasonably certain of preventing recurrence of ulcers, these observations have not been generally accepted as evidences of such an etiologic relationship. This has been largely due to the fact that confirmation of Rosenow's work was not conclusive, largely due to a difference in the technic used in the experiments. Rosenow having attributed the ulcers to infection by the Streptococcus viridans, it was natural that most later experiments by other workers were made with the intravenous injection into animals of pure cultures of these organisms with resulting failure to produce ulcers. Rosenow, in most of his work, injected suspensions of material obtained directly from the infective foci in which the organisms were found to be present on culture. This material contained more than organisms. It contained undoubtedly not only living and dead organisms and their products, but also tissue from the site of the infected area, more or less destroyed by the growth of the organisms, as well as phagocytes and other factors concerned with the local infection. And this fact brings us to the little noticed but pains-

taking and scientific studies of Fenton B. Turck,[2] who demonstrated the production of typical indurated ulcers in dogs following the intravenous injection of extracts made from macerated tissues of the same animal or of another animal of the same species. He attributed the production of the ulcer to a toxin which he at first called cytolysin and later cytost, present in dead tissues, and which, when injected, would produce areas of focal necrosis in various parts of the body, usually where there was an end artery, as along the lesser curvature of the stomach. Three entirely independent observations seem to confirm Turck's findings:

1. The presence of cytost in Rosenow's suspensions or its absorption from infective foci would explain the production of ulcers and other lesions entirely independent of infection, bacterial migration taking place later because of the production of proper "soil conditions" at the new focus.

2. The absorption of cytost from extensive burns of the skin, from comminuted bone fractures and from fields of operation would account for the hitherto unexplained occurrence of ulcers following such injuries. It brings up the question whether the changed physiological processes following experimental operative procedures in animals produce the ulcers observed to follow these procedures or whether they are caused by absorption of cytost from the operative field. In humans, the perforated ulcers following cholecystectomy, appendectomy or pelvic operations can be explained on this basis.

3. The pathological work on ulcer done by Lewis Gregory Cole[3] and confirmed by many pathologists, demonstrates that peptic ulcers start as areas of focal necrosis under the mucosa undoubtedly due to some blocking of the circulation, as from an obliterating endarteritis or arterial spasm, breaking through the mucosa much as boils do in the skin and healing rapidly, with more or less scarring depending upon the size of the ulcer and its location. If the necrotic area is deeply located near the serosa, it may break through the serosa alone, producing adhesions, or in conjunction with a break in the other direction, producing perforation. Involvement of blood vessels in the necrotic area accounts for hemorrhage. The rapid attraction to the necrotic and later ulcerating area of all cells and fluids having to do with healing accounts for the induration, edema, round cell infiltration and rapid healing, with larger and smaller areas of cicatrization depending upon the size and location of the ulcer. Deeply located necrotic areas, with serosal reactions or with partial or complete but walled-off perforations, often producing cysts or abscesses protected by plastic exudates or by adhesions to neighboring organs, account for the finding of perigastric and periduodenal adhesions to omentum, gallbladder, biliary tract and pancreas. These excessive reactions with resulting dense scarring, horny induration, deforming adhesions and obstructions may produce persistent symptoms due to their actually interfering with the healing of the ulcer or to the production of symptom producing complications.

That there are such things as *allergic ulcers* has been amply demonstrated. Usually multiple, they resemble "canker sores" and heal in the same manner. They produce very aggravated ulcer symptoms, and may often be the site of severe hemorrhages, small size and rapid healing accounting for the absence of roentgenologic evidences of the cause of the bleeding. Recently we have seen through the gastroscope such ulcers resembling small erosions in three cases of recurrent gastric hemorrhage in individuals known to be victims of food allergy. Whether Turck's ulcers were really allergic in origin or whether all ulcers are allergic manifestations, due to sensitization to some substance produced at the site of an infective focus, an operative field or an extensive area of necrosis of tissue, is still open to question. The fact remains that most ulcers develop after there have been symptoms of some acute infection elsewhere or of increased activity or after some

operative procedure at a previously existent infective focus. In a susceptible individual the occurrence of ulcer symptoms after such a story is a perfectly normal situation and can be demonstrated to be due to an entirely new ulcer and not to intractability on the part of an ulcer previously demonstrated.

In discussing intractability of ulcer, it has frequently been considered proper to consider *symptoms* the criterion of intractability. However, the *hunger pains* of ulcer, due to excessive hunger contractions in a stomach made irritable by the presence of the ulcer, may persist for a time after the healing of the ulcer can be definitely established. Hunger pain due to repeated or continuous though often small allergic ulcers will persist until the foods to which the patient is sensitized are removed from the diet. The *persistent pains*, often immediately aggravated by food, seen in the deep or serosal type of ulcers, and due to peritoneal irritation or distention by the pressure of food extruding into the deep crater, usually subside with healing of the ulcer; but, if actual walled-off perforation has occurred interfering with such healing, these pains may be quite persistent and may call for operative relief, even when their cause has not been recognized. *Pains referred* to other regions co-incidently diseased, as in the case of the right subcostal pains in which biliary tract disease is a complication, the right lower pains occurring with ileocecal or appendiceal pathology or the left lower pains of sigmoid or pelvic disease, are often a confusing factor. If due to ulcer, these pains usually occur at the hunger period and disappear with ulcer healing, but if due entirely to the co-incident disease they may occur at any time and may persist even though the ulcer is healed. If the character of the pains occurring in ulcer is carefully studied, confusion with the pains of cardiac or pulmonary lesions or of tabetic crises can usually be avoided. The *retrostaltic symptoms*, fulness, heartburn, belching, sour eructations or regurgitations, may be due to the ulcer itself, to complicating causes or only to habit. The *vomiting*, which may be retrostaltic in origin or due to the presence of an ulcer at or very close to the pylorus, may disappear with the subsidence of the swelling around an active ulcer, or may persist, due to the subsequent development of a real organic obstruction from a scar or from perigastric or periduodenal adhesions. The *hemorrhage*, when mild, due to surface bleeding or capillary oozing, will usually subside rapidly with healing of the ulcer. Severe hemorrhages due to small deep multiple ulcerations or to the tearing across or erosion of a vessel involved in the necrotic process, while usually subsiding quickly in ordinary cases under proper care, may be quite intractable in the presence of marked horny induration or of dense adhesions holding a vessel stiffly open. In such cases even operative interference may be futile.

From the foregoing discussion it is readily seen that if operative measures are to be instituted for the treatment of intractable ulcers, it is not wise or safe to use symptoms as a criterion of intractability. As has been pointed out, symptoms may be persistent even though an ulcer has healed completely and satisfactorily, and it is in such cases that so often unnecessary and even decidedly harmful operative attacks upon the stomach have been made in the hope that short-circuitings or excisions might influence symptoms or prevent recurrences of ulcers. The only true criterion of intractability is one based on anatomical findings as observed by standard procedures such as gastric analysis and roentgenological or gastroscopic studies repeatedly performed, and in the following discussion the subject will be discussed from that viewpoint. It is convenient to divide the cases with persistent ulcer symptoms into three groups: those showing no roentgenological evidence of ulcer, those showing evidence of the presence of an uncomplicated ulcer and those with evidence of complications:

I. *In the absence of roentgenological evidence* of the presence of an ulcer even though typical and persistent ulcer symptoms are present there may at times be also no evidence of ulceration by either gastroscopy or gastric analysis, the gastric irritability being due either to psychoneurological factors, to nonulcerative allergic reactions or to the fact that the ulcer causing the irritability has healed before the observations are made. Or on reviewing the case it may be found that the symptoms may not be typical of ulcer but may be of cardiac, pulmonary or tabetic origin. However, in many cases visible blood may be seen in the gastric contents during fractional removal and there may or may not be evidence of disturbed secretion. In these cases, gastroscopy may often reveal the lesion causing the symptoms and findings: there may be a small single ulcerative lesion suspicious of early malignancy or there may be multiple small mucosal ulcers suggesting an allergic origin. In the latter cases a study of the patient's allergic reactions to food or other substances should establish the diagnosis, should reveal the causes of the gastric mucosal reactions and should therefore indicate the method of successful treatment, usually merely abstinence from the foods causing the reactions. In the cases suspected of malignancy, repeated observations should be made to determine whether the lesion heals, indicating its benign nature, or whether it shows no tendency to heal but rather to increase in size, indicating its malignancy. In the rare cases in which through a rigid gastroscope a biopsy specimen might be obtained from such an area, a very early diagnosis could be made and a fine chance for surgical cure would be available.

II. *Where roentgenologic evidence of an uncomplicated ulcer is present* in stomach or duodenum, and the symptoms and signs do not subside in the usual manner, several explanations for their persistence may offer themselves:

1. The most important reason may be that the diagnosis was incorrect, that what was thought to be a simple gastric ulcer was really a carcinoma. In such cases early gastroscopy may at times show the typical appearance of malignancy and there may be a persistence of blood in the gastric contents on repeated observations. However, on repeated roentgen study within two to four weeks the persistence or increase in size of the ulcer crater and defect or their beginning irregularity of outline should occasion a very definite suspicion of carcinoma and indicate immediate wide excision of the affected area, even though at operation the gross findings might not be typically those of malignancy.

2. The persistence of the ulcer may be due to the fact that it is due to a specific infection, such as a tuberculous or syphilitic ulcer, although such ulcers more closely resemble carcinoma than simple ulcers. The tuberculous ulcer may take a long time to heal; the luetic one may clear up quickly under thorough antisyphilitic therapy, although both may leave deformities which would make exploration, because of the possibility of malignancy, desirable.

3. Unless careful comparison of films is made, the ulcer found on later observations and really a new ulcer at a different location in stomach or duodenum, may be mistaken for persistence of original ulcer. Such development of successive ulcers is not uncommon and is usually due to recurrent activity or operative attack upon some infective focus, to some new local or general infection or to an allergic reaction, the history being often quite clear in regard to one of these factors. No operative interference is necessarily indicated in such a case, as the new ulcer may go on to the usual spontaneous cure.

4. A persistence of the symptoms and roentgenologic signs of ulcer may be due to *complications* which may have been present but overlooked in the original study of the case. Such complications may be of several types, as follows:

A. They may be inherent in the ulcer itself, as in the case of a marked horny induration keeping the ulcer from healing,

of external adhesions and deformities keeping its edges apart or of actual walled-off perforation accounting for the persistent crater seen in the roentgen films.

B. They may be lesions in stomach or duodenum which tend to irritate the ulcer and interfere with healing, or to cause persistence of symptoms even after the ulcer has healed. Adenomas or diverticula or even a severe gastritis or duodenitis may be included in this group. Treatment will depend upon the nature of the lesion.

C. They may be lesions in other parts of the gastrointestinal tract and its appendages, such as the biliary tract, pancreas, appendix, colon and rectum, which by reflex or retrostaltic irritation or in the case of the biliary tract and pancreas, by contiguity or adhesions, aggravate and prevent the rapid healing of the ulcer. Such cases may require operation for relief of the persistent symptoms.

D. They may be lesions located outside of the gastrointestinal tract, acting entirely through a reflex mechanism, or also through contiguity or adhesions to the gastrointestinal tract, producing retrostaltic phenomena, either keeping an ulcer from healing or causing posthealing persistence of symptoms. Lesions of the pelvis or the urogenital tract are included in this group, and in these cases also operation may be necessary.

E. The complications causing persistence of signs or symptoms of ulcer may be endocrine in character, with thyroid, parathyroid, pituitary, adrenal or gonadal dyscrasias occasionally responsible and requiring appropriate treatment.

5. At times the actual *treatment may be responsible* for the long continued failure of healing of an ulcer. A diet containing insufficient vitamins, the use of alkalis to the point of alkalosis or the employment of drugs to which a patient is allergic may surely prevent and prolong such healing. It is therefore important, before declaring an ulcer intractable, to be sure that a safe and adequate course of treatment has been previously prescribed and carried out.

III. *Complicated ulcers* should usually be recognized at the time of the original study of a case. Marked deformities in the prepyloric or postpyloric regions, especially with deep craters or pockets, fixed or almost immovable on fluoroscopic study, with or without evidences of obstruction, and giving the appearance and often the physical evidence of the presence of a mass, should be suspected from the start as being complicated ulcers or malignancies. In such cases a careful ulcer régime should be promptly instituted, and if on rest, suitable diet and eradication of focal infections such a patient still shows the same roentgen findings at the end of three or four weeks, prompt surgical treatment is indicated. Even in severe cases the period of ulcer treatment is not to be considered a waste of time, as it is surprising how some cases, even with marked obstruction, will have almost cleared up during the interval. And in the cases in which operation must be performed later, the improvement in the patient's general condition, the correction of circulatory and nutritive deficiencies and the restoration of more normal tone to the gastric and intestinal musculature will do much to insure an uneventful postoperative course. These complicated cases are the ones which are usually described as intractable, as "failures of medical treatment," and surgeons love to present the removed specimens at meetings, asking how medical treatment could possibly have cured such ulcers. It is imperative that these cases should be recognized at the start, that patients be told that operation will probably be necessary and that the treatment being recommended will encourage healing, if this is possible, and will assure a successful operation if this is required later. In order to be certain that no other complications are being overlooked it is necessary, before instituting treatment in any case of ulcer, that not only a complete gastrointestinal study be carried out, but that any pathological conditions in the biliary tract, pancreas, urogenital organs, respiratory tract

and cardiovascular system be searched for and properly treated. It is only by painstaking care that patients with ulcers can be successfully treated.

SUMMARY

1. Peptic ulcer symptoms may occur without demonstrable ulceration or may persist after healing of ulcer.

2. Persistent ulcer symptoms may be caused by gastric carcinoma, tuberculosis or syphilis.

3. Persistent ulcer symptoms may be caused by successive ulcers at short intervals, new ulcers in slightly different locations being recognizable upon study.

4. Persistent ulcer symptoms may be caused by complications of the ulcer or complications other than in the ulcer itself, many requiring operative interference.

5. Allergy may cause repeated ulcers, may prevent healing or may produce symptoms simulating ulcer.

6. Inadequate or improper treatment may prevent healing and thus prolong symptoms.

7. The truly intractable peptic ulcer is a complicated ulcer, one prevented from healing by scarring, walled-off perforation, adhesions, deformities or obstruction, and should be recognized as a probable surgical case at the time of the initial study.

8. Operation should not be performed in any case until careful and repeated studies have revealed true persistence of an ulcer or permanent deformity resulting therefrom.

REFERENCES

1. ROSENOW, E. C. *J. A. M. A.*, 61: 1942, 1913.
2. TURCK, F. B. *J. A. M. A.*, 46: 1753–1763, 1906.
3. COLE, L. G. *Acta Radiol.*, 9: 533–545, 1928.

ALBERT F. R. ANDRESEN, M.D.

Original Articles

IMMEDIATE COMPLICATIONS OF OPERATIONS FOR ACQUIRED CATARACT*†

CERTAIN COMPLICATIONS AFFECTING THE ANTERIOR AND POSTERIOR SEGMENTS OF THE EYEBALL

CONRAD BERENS, M.D. AND DONALD BOGART, M.D.
NEW YORK, NEW YORK

PART I—ANTERIOR SEGMENTS

THE great importance of preventing complications of cataract extraction in relation to the prevention of blindness is well known and has been a stimulus for this study. The first steps in the prevention of these complications are a thorough preoperative study of the patient and the treatment of focal infections as well as other general diseases. Because of the more universal adoption of the intracapsular method and its more general use by young surgeons in training, we believed that a study of the immediate complications of cataract extractions performed during a two-year period at the New York Eye and Ear Infirmary and a careful review of the literature might furnish valuable information. A total of 1,004 clinic patients were operated upon for acquired cataract by surgeons, assistant surgeons and house surgeons. Of this number 302 were intracapsular extractions and 702 were extracapsular extractions. (Table 1.) Mature senile, immature senile, hypermature, complicated, congenital, cortical, posterior cortical, nuclear, perinuclear, cataracta nigra, coerulean, diabetic, traumatic, posterior polar and anterior polar cataracts are included in this series.

It is interesting to note that 50 per cent of the extracapsular extractions were performed after preliminary iridectomy. This would seem to indicate that extraction with preliminary iridectomy is still considered by some surgeons the safest operation and is especially desirable in the presence of complications. This finding coincides with the consensus of opinion of the surgeons at the International Congress of Ophthalmology in Washington in 1922.

TABLE 1
TYPES OF OPERATION PERFORMED IN 1,004 CATARACT OPERATIONS

Operation	Intracapsular	Extracapsular
Extraction after preliminary iridectomy	118 (39%)	351 (50%)
Combined	176	341
Simple	7	10
Extraction after trephine	1	
Total	302	702

The average age of the patients upon whom intracapsular extraction was performed was sixty-five, although the ages ranged from twenty-seven to ninety years. Van Lint[1] employs the intracapsular method in patients over sixty years of age. However, many surgeons prefer to use this method on the majority of patients over fifty years of age. In the extracapsular

* Presented before the Pan-American Medical Association, January 15 to 31, 1938.
† Aided by a grant from the Ophthalmological Foundation, Inc.

series, the average age was sixty-two, although the ages ranged from twenty-two to eighty-five years.

The immediate complications of the intracapsular and extracapsular extractions occurring in the 1,004 patients are tabulated in Table II. The results are expressed in terms of final corrected vision. The fact that many of the patients did not return or were unable to be contacted following their discharge from the hospital is a challenge to the social service department of the hospital. Unfortunately, this situation is not limited to one hospital.[2–5] Although some patients may not have returned because of illness or could not be located because of incorrect or fictitious addresses, some clinic patients apparently believe that an improved visual field and perception of light is all that can be expected following cataract extraction and therefore never return to be examined for cataract lenses.

TABLE II
COMPARISON OF COMPLICATIONS IN INTRACAPSULAR AND EXTRACAPSULAR CATARACT EXTRACTIONS IN 1,004 PATIENTS

Complications	Intracapsular (302 Cases)	Extracapsular (702 Cases)
Loss of vitreous	30 (9.9%)	63 (9. %)
Prolapsed vitreous	1	2
Hemorrhage in anterior chamber	12 (4%)	10 (1.4%)
Expulsive hemorrhage	2 (0.7%)	3 (0.43%)
Dislocated lens	1	1
Loop extractions	4 (1.4%)	34 (5%)
Collapse of cornea	1	1
Prolapse of iris and ciliary body	1	0
Detachment of choroid	1	0
Capsule remains in anterior chamber	0	1
Total	53 (17.5%)	115 (16.4%)

Discussion of Table II. Among the intracapsular extractions, loss of vitreous was the most frequent complication, occurring in 9.9 per cent of the 302 cases. This complication was also most frequently observed in the extracapsular cases; the percentage being 9. However, it must be remembered that the number of cases in the extracapsular series was considerably larger than that in the intracapsular series. Moreover, the majority of the extracapsular extractions were performed for complicated cataract. This would seem to suggest that loss of vitreous in the hands of the average ophthalmic surgeon is more likely to occur with the intracapsular than with the extracapsular method. The fact that the incidence of vitreous prolapse is slightly greater is offset largely by the freedom from postoperative endophthalmitis probably phacogenetic[6] or phacoanaphylactic[7] which was previously reported.[8]

The lens was extracted by means of a loop in thirty-four (5 per cent) of the extracapsular cases while this procedure was only necessary in four (1.4 per cent) of the intracapsular cases.

Hemorrhage occurred in twelve (4 per cent) of the intracapsular extractions and in ten (1.4 per cent) of the extracapsular extractions.

The fact that the incidence of expulsive hemorrhage was higher after the intracapsular operation possibly suggests the greater danger of this method.

The other complications, which were observed, occurred only in a few cases but the percentage of incidence was approximately the same following both procedures.

The complications occurring in the posterior portions of the eyeball not included in the anterior segment will be discussed in a later communication.

I. COMPLICATIONS ASSOCIATED WITH THE INCISION

A. Improper Introduction of the Graefe Knife. If care is not exercised in placing the cutting edge of the knife upward, introduction of the Graefe knife with the sharp edge of the blade downward is a fairly common mistake. If this error is noted before the counterpuncture is made, it is advisable to remove the knife and wait for the restoration of the anterior chamber. If the malposition of the knife is not noted

until the counterpuncture has been made, it is usually better to remove the knife and dissect a small conjunctival flap downward,

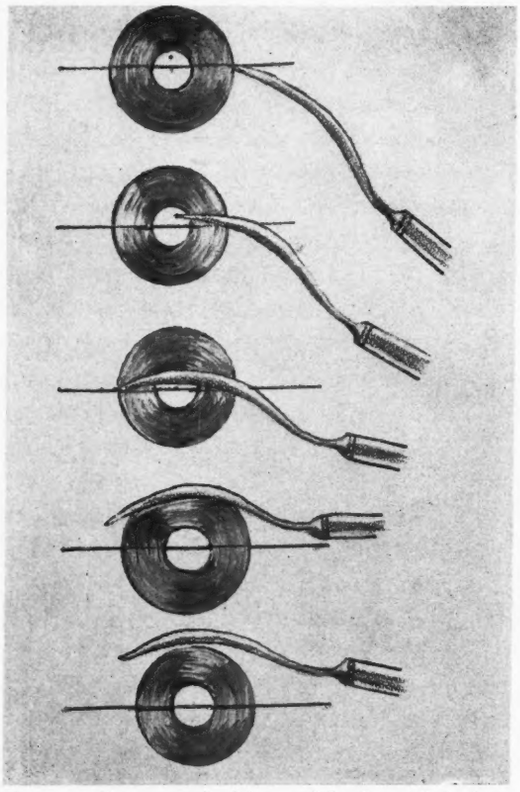


FIG. 1. Cataract incision with Jones-Scimiter knife.

completing the incision with special sclerotomy scissors.[9] If the knife is reversed in the wound, the aqueous is usually lost. Moreover, the anterior chamber will be so shallow that the iris may be injured while attempting to complete the section, unless the incision is extremely high in the cornea or an iridectomy has been performed. We prefer to complete the section with scleral scissors rather than wait several days, as is suggested by some authors. Improper introduction of the knife, especially at the counterpuncture may be caused by dilatation of the pupil. This may be prevented by the use of butyn or pontocain as a local anesthetic.

Introduction of the knife reversed in making a section is not nearly so frequent or dangerous as placing the point of introduction of the knife or the counterpuncture too far posteriorly, nor as inconvenient as a section too far forward which often splits the cornea leaving a posterior corneal shelf. Inexperienced surgeons attempt all too often to make a large section even with a dilated pupil. It is better to follow the general rule that in making an upward section the back of the knife be level with the pupillary margin in passing across the anterior chamber.

II. COMPLICATIONS ASSOCIATED WITH THE IRIS

A. Injury to the Iris. If the point of the knife in entering the anterior chamber engages the iris, it should be directed further forward. However, if iridodialysis is being produced, withdrawal of the knife may be necessary until the anterior chamber has reformed. Bulging of the iris in front of the knife as the counterpuncture is made may be caused by loss of aqueous or a shallow chamber. The curved cataract knife of Paton[10] or the scimiter-shaped knife of Jones (Fig. 1) should be employed in the presence of a shallow chamber. A complete section can be made with little pain provided anesthesia has been carefully induced. (At times, a complete iridectomy may be performed with the Graefe knife. If a bridge of iris is left, this may be cut after grasping it with a blunt Tyrrell hook or with iris forceps or may be excised after the lens is expressed.) If the anterior chamber is unusually shallow, we prefer to make the section with a hollow ground keratome[11] or high in the cornea with a curved cataract[10] or glaucoma knife enlarging the incision with scleral scissors.

B. Incomplete Iridectomy and Iridodialysis. Cause: If the iris is not completely anesthetized when it is grasped with iris forceps or when withdrawal is attempted, the pain experienced by the patient may cause a sudden movement of the eyeball. One of us has seen a patient in whom complete aniridia was produced. In several cases of this group extensive iridodialysis was observed.

Prevention. To guard against incomplete iridectomy, iridodialysis and trau-

matic cataract, anesthetize the iris well. If cocaine is used, wait until dilatation of the iris occurs; warn the patient that he may experience slight pain and not to move. Moreover, the iris scissors should be open and in position to cut the iris immediately. In a congested eye the subconjunctival injection of a solution of cocaine ½ per cent with epinephrine, when allowed five minutes for absorption, will prevent the pain in pulling on an iris with iris forceps. A rigid iris may contraindicate intracapsular extraction.

C. Tendency for the Iris to Prolapse. Incidence: Tendency for the iris to prolapse occurred in a large number of cases. This complication requires immediate treatment even though the wound is to be sutured.

Treatment. We have made it a rule never to perform simple extraction but always to excise, at least, a small piece of the peripheral iris. If one peripheral iridectomy does not prevent the tendency to immediate prolapse, a second peripheral iridectomy may be performed. However, if the sphincter is known to be weak or the iris is atrophic, it is wise to perform complete iridectomy. According to Bulson[12] the combined operation and a large conjunctival flap are the best measures to prevent iris prolapse.

D. Prolapse of Iris and Ciliary Body. This complication is usually considered as a postoperative complication but in one intracapsular operation, the patient complained of severe pain in the eye operated upon shortly after leaving the operating room. Upon inspection of the wound, it was found that the iris and ciliary body had prolapsed through the wound. Following iridectomy a conjunctival flap was brought down to cover the area.

E. Complete Removal of the Iris. Among the more unusual complications associated with cataract operations is the complete removal of the iris during an attempted preliminary iridectomy.[13] One of us (C. B.) observed a patient in whom the iris was completely removed but extraction was successfully performed. Hemorrhage is usually profuse and following the operation deeply tinted lenses should be worn to protect the eyes from glare.

III. COMPLICATIONS ASSOCIATED WITH THE LENS

A. Difficulty in Expressing the Lens. Although pressure and counterpressure should cause the lens to present in the wound, the following factors may interfere:

1. *Small section:* If the nucleus is small and the cortex is soft, the lens may be extracted by traction with capsule forceps or by carefully passing a spoon in back of the lens while making counterpressure from below. However, striate keratitis may result. If the lens is large and hard, the incision should be enlarged with scleral scissors. One blade of the probe-pointed scleral scissors is passed between the cornea and the iris into the anterior chamber pressing the external blade slightly backward toward the sclera in order to bevel the incision. Too large an incision favors vitreous prolapse and also incarceration or prolapse of the iris in the wound. However, it is usually preferable to have too large rather than too small an incision.

2. *Insufficient opening in the anterior capsule:* If the incision in the lens capsule is not sufficiently large, a cystitome should be used in attempting to make a broad incision in the capsule at the upper margin of the lens. If the capsule is difficult to open, it is usually better to attempt to extract the lens in capsule.

3. *Interference by scleral lip of the wound:* The upper margin of the lens may be caught by the scleral lip of the wound. This is likely to occur if the lens is subluxated before or during the operation or pressure with the expressor is improperly applied. Dislocation of the lens is best accomplished by pressure directed backward and downward at the limbus, not moving the expressor until the lens ceases to move forward and upward. The lens should be pushed gently downward with a spatula and pressure reapplied to the lower margin of the cornea while holding the scleral lip of the

wound down. If this procedure fails, pass a spoon carefully behind the lens while making gentle counterpressure from below. No

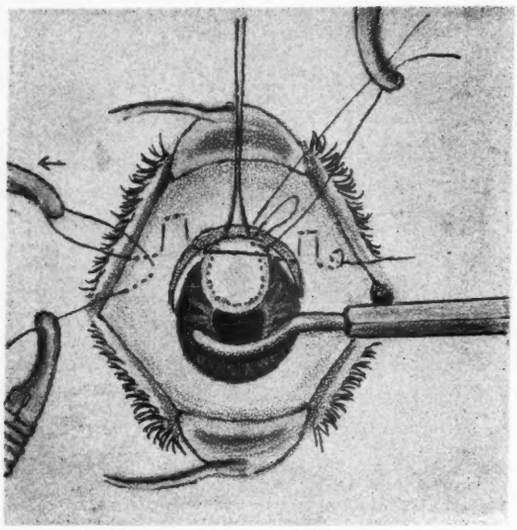


FIG. 2. Lens extraction with loop and expressor as wound is closed by traction on the sutures.

vitreous need usually be lost by following this procedure.

4. *Low Intra-ocular pressure:* If the retrobulbar injection is given too long before operation, low intra-ocular pressure may interfere with the extraction.

B. Dislocation of the Lens. Incidence: The lens was completely dislocated in one case in each series of extractions. The lens was extracted with a loop in thirty-four (5 per cent) of the 702 extracapsular extractions and in four (1.4 per cent) of the 302 intracapsular extractions. The visual results are shown in Table III.

Discussion of Table III. The use of a loop seems to be a dangerous procedure in the hands of the average surgeon. This complication was more serious in the extracapsular operations. Moreover, four patients of this group did not obtain useful vision. It was necessary to extract a greater number of lenses with a loop in the extracapsular series, and in many cases the final visual acuity was markedly subnormal. However, in evaluating the two methods of operation it must be remembered that in the extracapsular series a majority of the cases had complications preoperatively.

Cause of Dislocation of the Lens. In some cases, the hyaloid of the vitreous is ruptured by too much pressure with the fixation forceps and some vitreous will escape. The lens instead of entering the wound tends to be dislocated backward into the vitreous. Complete dislocation is caused by too much pressure or traction in making the discission. This is especially true when

TABLE III
CORRECTED VISUAL ACUITY IN EXTRACTIONS PERFORMED WITH A LOOP

Final Vision	Intra-capsular	Extra-capsular
20/20	..	2
20/30	..	2
20/40	2	5
20/50	..	1
20/70	..	3
20/100	..	4
20/200	1	1
30/200	..	1
Fingers	..	1
3/200	..	1
Light projection	..	1
No improvement	..	11
Eye lost	..	1
Not recorded	1	
Total	4 (1.4%)	34 (5%)

the capsule is tough or excessive pressure, improperly applied, is exerted against the eyeball when expressing the lens, particularly when the section is too small. In some cases, the lens may sink into the vitreous. This is a serious complication. Woodruff[14] believes that it is more likely to occur with the Barraquer suction operation.

Treatment. As soon as the malposition of the lens is noted, a thin spoon or wire loop should be passed gently in back of the lens keeping as close to the posterior capsule as possible, while making very slight counterpressure below with a strabismus hook or lens expressor. (Fig. 2.) The lens should be removed as quickly as possible and the wound closed with sutures. If the lens is completely dislocated, the use of an ultraviolet lamp[15] is of value in locating the

lens in facilitating its extraction with a wire loop, preferably one with teeth.

C. Ruptured Capsule and Retained Cortex. Incidence: The capsule was ruptured in seventy-one cases (7.1 per cent) of the 1,000 cataract extractions reported by Bothman.[16] In an analysis of the 1,343 intracapsular cataract extractions made by Greenwood and Grossman[17] the capsule was ruptured in approximately 5 per cent of the cases. In our series of intracapsular extractions the capsule was ruptured in 119 cases.

Cause. According to Walker[18] a ruptured capsule is usually due to the resistance of the zonular ligaments in approximately 10 per cent of the cases. Too large a bite of the capsule has seemed to be an important factor in causing rupture in some of our cases and this fault has been automatically controlled by the construction of several capsule forceps.[19,20,21] Where the forceps is applied is another important point in preventing this complication.

Walker[18] found that applying forceps to the anterior and posterior surface of the lens, as advised by Verhoeff, caused the capsule to rupture more frequently than when he applied his capsule forceps to the anterior surface alone near the equator where the capsule is thick.

Prevention. The frequency of this complication may be diminished by employing one of the following methods: subluxation of the lens followed by expression (Knapp); expression combined with traction (Elschnig); phacoerisis (Barraquer) and the suction method (Fisher).[22] In cases in which a weak or tense capsule is suspected a complete iridectomy should be performed.

Treatment. The Hildreth lamp is of great value in washing out all of the remaining soft lens, a procedure we do not fear when performed in the manner depicted in Figure 3. Close the wound with scleroconjunctival sutures, place the irrigating tip in one angle of the wound and a grooved spatula in the other angle and wash the anterior chamber thoroughly.

D. Incomplete Removal of the Capsule of the Lens. In one case of extracapsular extraction the anterior lens capsule was retained following the delivery of the lens. In this case vision was reduced to "fingers" prior to discission. Usually the capsule should be removed from the eye before the operation is completed. Nugent[23] recommends the use of a carbon-arc light with a uviol or blue-glass filter. After the wound is partially sutured the cornea should be raised slightly with clot forceps in one hand and the capsule extracted with the capsule forceps in the other hand.

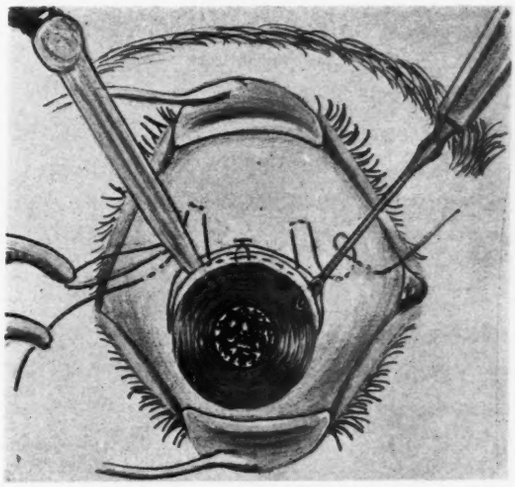


Fig. 3. Before removing soft lens matter close the wound with scleroconjunctival sutures, place the irrigating tip in one angle and a grooved spatula in the other angle.

IV. Complications Associated with the Cornea

A. Gaping of the Corneal Wound with Tendency to Iris Prolapse. After the section is made, the upper part of the cornea is pushed forward by iris and vitreous in approximately 25 per cent of eyes. This is usually the result of hypertension in the vitreous. A horizontally directed crease in the cornea may form because of the high tension within the vitreous or the pressure of a subchoroidal hemorrhage and the vitreous is likely to be lost if intracapsular extraction is attempted. Therefore, intracapsular extraction may produce less favorable results in this type of eye.

B. Collapse and Depression of the Cornea. Incidence: Collapse of the cornea occurred in one patient upon whom intracapsular extraction was performed and in one of the extracapsular extractions. The final vision was $^{20}/_{50}$ and $^{20}/_{30}$, respectively. According to Green[24] after the section is made the cornea is seen to be depressed in 60 per cent of the eyes.

Cause. If the cornea is inelastic when the intra-ocular pressure is lowered, it may collapse, especially when cocaine is employed. However, this is of no consequence, as it usually indicates lowered vitreous pressure and less danger from escape of vitreous. Depression of the cornea is one sign which indicates that the case is probably favorable for intracapsular extraction but subluxation of the lens should be excluded.

V. COMPLICATIONS ASSOCIATED WITH THE ANTERIOR CHAMBER

When a shallow anterior chamber is present, Gailey[25] first makes a Kuhnt flap, then a small section which is enlarged with scissors and extracts the lens by the capsulotomy method. We have injected half strength physiologic saline solution into the anterior chamber to deepen it or use a curved cataract knife.[10]

An eye with a shallow anterior chamber may have a slightly increased tension. Gailey[25] advocates a decompression operation first or a capsulotomy operation with a broad deep iridectomy. If the shallow chamber is associated with glaucoma, we dissect a conjunctival flap, introduce a keratome into the anterior chamber, introduce a running suture[26] with episcleral bites and then enlarge the wound with scleral scissors.[9] We prefer as small an iridectomy as possible in cataract extraction.

Needling of the posterior capsule immediately after cataract extraction should be avoided because this procedure permits a herniation of the vitreous body into the anterior chamber.

When premature loss of aqueous from the anterior chamber occurs, Gailey ash successfully filled the anterior chamber with the knife blade still in position by having the assistant apply the tip of the irrigator to the flat surface of the blade.

SUMMARY AND CONCLUSIONS TO PART I

1. The prevention of immediate complications following cataract extraction is important if unnecessary blindness is to be eliminated. A thorough preoperative study of patients with cataract and the treatment of focal infections, as well as other general diseases, are essential in order to eliminate some complications following the extraction of cataract.

2. A study of 1,004 intracapsular and extracapsular cataract extractions apparently demonstrates that the percentage of immediate operative complications is approximately the same following either procedure.

3. Cataract extraction after preliminary iridectomy apparently is still considered the safest operation by some ophthalmic surgeons, especially if complications are present preoperatively.

4. The average age of the patients included in the intracapsular group was sixty-five years and in the extracapsular group sixty-two years.

5. In this study, loss of vitreous, hemorrhage and the necessity of extraction by means of a loop were the most common immediate complications in cataract extraction. Loss of vitreous occurred in thirty cases (9.9 per cent) of the intracapsular group and in sixty-three cases (9 per cent) of the extracapsular group. Loss of vitreous apparently is a more frequent complication of intracapsular extraction than of extracapsular extraction even though intracapsular extraction is usually avoided in the presence of complications. However, comparative freedom from inflammatory postoperative complications when the intracapsular method is used must be considered in the final evaluation of the methods. Hemorrhage occurred in twelve (4 per cent) of the intracapsular group and in ten (1.4 per cent) of the extracapsular

group. Contrary to expectation, the incidence of hemorrhage into the anterior chamber was markedly different in the intracapsular and extracapsular methods, and we have no logical explanation of this fact. In this series of cases the lenses were extracted by means of a loop in thirty-four of the 702 extracapsular extractions and in only four of the 302 intracapsular operations. The fact that in the extracapsular series a majority of the cases had complications preoperatively must be considered. The other complications occurred in only a few cases of both groups of operations.

PART II—POSTERIOR SEGMENT

In the preceding discussion the general aspects of immediate complications of cataract extraction and the specific complications affecting the anterior segment of the eyeball were considered. This study is devoted to the general aspects of immediate complications of cataract extraction and especially to those affecting the structures of the posterior segment of the eyeball.

VI. COMPLICATIONS ASSOCIATED WITH VITREOUS

A. Loss of Vitreous. Loss of vitreous is undoubtedly the most common and important immediate complication of cataract extraction.

Incidence. Loss of vitreous occurred in thirty (9.9 per cent) cases of the 302 intracapsular extractions, and in sixty-three (9 per cent) of the 702 extracapsular extractions. The amount of loss varied from a minim or two to almost the entire vitreous body. The end results in terms of visual acuity are shown in Table IV. Results obtained by other authors are shown in Table V. According to Nugent[27] loss of vitreous occurs rarely in extractions by the traction method or when traction is combined with gentle expression.

Discussion of Tables IV and V. Loss of vitreous seems to occur more frequently in intracapsular than in extracapsular operations whether the operation is performed by the average ophthalmic surgeon or by the most experienced and dextrous surgeons.[28,30] A point to be considered in the final evaluation of the two methods is the fact that the intracapsular method is often avoided in complicated cases. Therefore, the vitreous loss might be even greater if this operation were attempted in complicated cases.

TABLE IV
THE RESULT OF LOSS OF VITREOUS IN TERMS OF CORRECTED VISION

Final Vision or Result	Intracapsular	Extracapsular
20/20	2	4
20/30	4	6
20/40	2	7
20/50	3	3
20/70	4	6
20/100	2	7
20/200	4	4
30/200	..	1
Fingers	..	1
Light perception	..	1
Atrophy of eyeball	..	1
Eye lost and ennucleated	2	
Vision not recorded	7	22
Total	30 (9.9%)	63 (9.%)

TABLE V
LOSS OF VITREOUS

Author	Total Number of Cases	Loss of Vitreous Occurred in	Type of Operation
Parker[28]	450		
	150	3 (2%)	Combined
	150	5 (3.3%)	Simple
	150	9 (6%)	Knapp-Török
Townes[29]	73	6 (8.2%)	Intracapsular
Greenwood and Grossman[31]	1,343	83 (6.2%)	Verhoeff Intracapsular
de Grosz[30]	15,050	376 (2.5%) (1%)	Extracapsular
		(4%)	Intracapsular
Berens and Bogart	702	63 (9%)	Extracapsular
	302	30 (9.9%)	Intracapsular
Knapp[32]	500	42 (8.4%)	Intracapsular
Botham[33]	1,000	45 (4.5%)	Indian
Total	19,420	662	

Cause. The delicate hyaloid membrane of the vitreous is the only barrier to escape of the intra-ocular contents, especially after the lens has been removed. Intra-ocular pressure, which is often augmented by

pressure of the eyelids and squeezing on the part of the patient or the development of a subchoroidal hemorrhage, may rupture the hyaloid membrane. Contraction of the extra-ocular muscles, which is a real menace in some cases, may be difficult to avoid. This condition is augmented by excessive pressure against the eyeball when the section is made, especially if the pressure is exerted at the insertion of the medial rectus muscle. Pressure must be greater if the knife is not sharp and vitreous may even appear as the section is made.

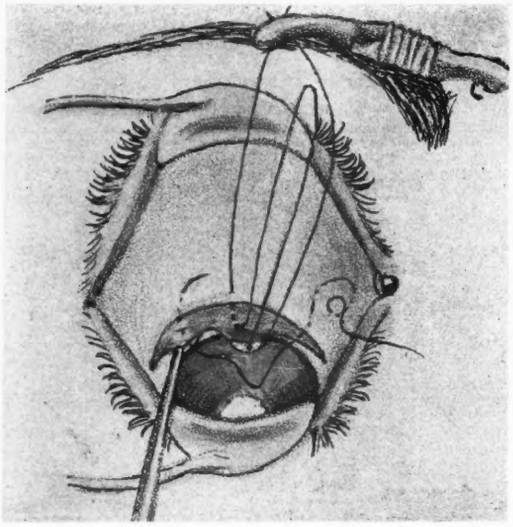


FIG. 4. An untied running suture inserted in the episcleral tissue and conjunctiva which is tightened as the lens is expressed. A centrally placed conjunctival episcleral suture is also employed.

The hyaloid membrane may also be ruptured in attempting to rupture the zonule with capsule forceps or to incise the capsule with the cystitome, especially if the capsule is tough or if the patients make a rapid movement of the eyeball. We believe the iris repositor is responsible for rupture of the hyaloid in some cases. Therefore, this instrument should be used with great care and preferably after the wound is partially closed by sutures.

Prevention and Treatment. Gentle, dextrous manipulation of instruments and the avoidance of pressure on the eyeball with fixation forceps or the speculum, especially during the expression of the lens, will do much to prevent loss of vitreous. If the vitreous tends to prolapse or actually prolapses before extraction, elevate the speculum immediately, introduce a loop or thin spoon, back of the posterior capsule, remove the lens and close the wound. If the vitreous appears after the lens is extracted raise the speculum and close the wound with a suture. If the vitreous is fluid, it may escape as soon as the incision is made. Gifford[34] reported a case in which so much fluid vitreous escaped upon incision that he stopped the operation and later treated the cataract by several needlings. Useful vision was maintained for five years.

We agree with Dunphy[35] that loss of vitreous would occur much less frequently if every cataractous eye were properly anesthetized at the time of the operation by means of the Van Lint eyelid injection, combined with either a deep orbital or subconjunctival injection.

One of us has long advocated the insertion of an untied suture early in the operation[36,37] which is now placed in the episcleral tissue[38] as well as the conjunctiva and is tightened as the lens is expressed. (Fig. 4.)

VII. HEMORRHAGE

A. Hemorrhage into the Anterior Chamber. Incidence: Hemorrhage at the time of the operation occurred in twelve cases (4 per cent) of the intracapsular series and in ten cases (1.4 per cent) of the extracapsular series. In the other cases bleeding occurred principally from the scleral vessels or those of the iris. The visual results are shown in Table VI.

Discussion of Table VI. There was marked difference in the incidence of hemorrhage into the anterior chamber in the intracapsular and extracapsular methods. It is impossible to explain why the incidence was greater in the intracapsular group as postoperative complications were less in this series of cases.

Cause. Hemorrhage into the anterior chamber may follow conjunctival or scleral bleeding. However, it is more likely to occur from the iris, especially if the pa-

tient's vessels are sclerotic or if there is a disinsertion of the iris. Sudden diminution of increased intra-ocular tension and general hypertension also may be possible causes.

In irides with prominent new vessels and in arteriosclerotic individuals, free bleeding is commonly observed; therefore, too much manipulation, unnecessary cutting or too strong a pull placed upon irides by atropine or eserine should be avoided.

TABLE VI
VISUAL RESULT IN CASES WITH EXCESSIVE HEMORRHAGE INTO ANTERIOR CHAMBER

Final Vision	Intra-capsular	Extra-capsular
20/20	1	
20/30	2	2
20/40	2	
20/70	1	1
20/200	1	1
5/200	..	1
3/200	..	1
Fingers	..	2
Shadows	..	1
Eye lost	3	
Not recorded	2	1
Total	12 (4%)	10 (1.4%)

Prevention. Nugent[27] advises the instillation of adrenalin-chloride preoperatively as an aid in the prevention of hemorrhages during the operation. However, the risk of postoperative hemorrhage has been said to be greater if adrenalin is used. However, Jensen[39] made a study of eighty cases of cataract extraction in which adrenalin was used in every other case. A comparison of the results obtained showed that the percentage of hemorrhage into the anterior chamber was about the same. However, in the cases in which adrenalin was not employed the majority of hemorrhages occurred at operation, while following the use of adrenalin they occurred within the first forty-eight hours after operation. To avoid retrobulbar hemorrhages Gailey[40] suggests the use of Harvey Cushing's technic in brain surgery, that is, to inject very slowly ahead of the advance of the tip of the needle. Coagulation and bleeding time should be studied preoperatively and abnormalities corrected. In cases of arteriosclerosis, Wright[41] recommends an injection of 1½ gr. of calcium in 10 cc. of distilled water intravenously. However, we prefer to use calcium gluconate.

Treatment. In conjunctival or scleral bleeding the anterior chamber should be washed out with half strength physiologic saline solution. If the hemorrhage occurs from the iris, it is usually advisable to wash out the anterior chamber several times before performing capsulectomy or capsulotomy or attempting to remove the lens in capsule. Abramowicz[42] advises the introduction of air into the anterior chamber in order to remove blood and produce a clear view of the anterior lens surface, thus facilitating the capsulotomy or the application of forceps for removal of the lens.

If after the lens is extracted bleeding occurs, it may be washed out or removed with clot forceps, for if much soft lens matter remains it usually absorbs more quickly and completely if no blood remains. If a vessel in the wound bleeds persistently, the electrocautery or trichloracetic acid may be applied.

It has been stated that the secondary membrane is likely to be more dense in the presence of hemorrhages. This seemed to be true in one patient who had dinitrocresol cataracts. One year after operation the vision in the right eye, in which no hemorrhage had occurred, was 20/15 and in the left eye in which a hemorrhage had filled the anterior chamber, the vision was 20/20 and the secondary membrane was much more dense.

B. Choroidal and Expulsive Hemorrhage. Choroidal and expulsive hemorrhages are the most dangerous of all complications during cataract extraction.

Incidence. Expulsive hemorrhage occurred in two cases of the intracapsular series and in three of the extracapsular cases. In the three cases in the extracapsular series the eyes were eviscerated while

in the intracapsular group the eye was enucleated in one patient and in the other, the eye was eviscerated.

Cause. Increased intra-ocular tension probably is an important predisposing cause of choroidal hemorrhages. In a study of 2,200 cases of cataract extraction, Nugent[27] reports choroidal hemorrhages in seventeen cases (sixteen patients, 5 per cent). The average intra-ocular tension for the seventeen cases was 43 mm. of mercury (Bailliart) and the blood pressure was normal.

Prevention. An attempt should be made to reduce intra-ocular pressure preoperatively. If this fails, use a retrobulbar injection ½ to 1 cc. of 2 per cent solution of procain with 3 m. of a 1:1000 solution of epinephrine hydrochloride. If pressure remains elevated, perform posterior sclerotomy. Lowering the general blood pressure by the preoperative removal of several hundred cubic centimeters of blood and the injection of the ciliary ganglion are two precautions which are believed to aid in preventing this serious complication. However, Gifford[43] does not approve of withdrawing blood since it is generally followed by a vasomotor reaction which immediately sends more blood to the peripheral circulation. Blood pressure may often be reduced by preliminary medical care and more effectively by several days of rest in bed before the operation.

In cases with hyperpiesis, preventive measures consist in eliminating all unnecessary pressure and traumatism. The lens should be expressed slowly so that intra-ocular pressure is not reduced too suddenly.

Treatment. Hemorrhage usually appears after the expression of the lens. The eyelids should be closed immediately, the wound sutured and a light compressing dressing applied. The patient should rest with his head and torso as nearly erect as possible. Even though the intra-ocular contents escape, it is sometimes better to postpone enucleation because of the psychologic effect upon the patient.

Vail[44] has reported two cases of subchoroidal expulsive hemorrhage, in which posterior sclerotomy as suggested and used successfully in one case by Verhoeff[45] saved the eyes and prevented complete deterioration of vision. In both cases an incision with a Graefe knife in the temporal side of the eyeball resulted in the appearance of bright red blood and the subsidence of pain within a relatively short time. This procedure has been used by one of us (C. B.) with retention of the eye and resulting vision of hand movements.

C. Detachment of the Choroid. Incidence: Detachment of the choroid occurred in only one case of the intracapsular group. Final vision was not recorded. Fuchs[46] gave the incidence of detachment of the choroid as 4.7 per cent of all extractions. Barkan[47] reported a large series of cataract extractions with detachment of the choroid occurring in approximately 4.5 per cent of the cases. Hagen[48] reported eleven detachments in a series of fifty consecutive cataract extractions, an incidence of 22 per cent. O'Brien[49] made a study of 140 consecutive cases of cataract extraction in which detachment of the choroid occurred in eighty-six cases (93 per cent).

According to O'Brien[49] detachment of the choroid occurs at operation in almost every case. It is impossible, however, to determine the exact incidence, since the fundus is not always visible as a result of blood, air or cortical material in the anterior chamber. In those cases in which the fundus can be seen immediately after the operation the detachment of the choroid, according to O'Brien, is almost invariably found.

Cause. Detachment of the choroid occurs usually in cases which present a shallow or empty anterior chamber, folds in Descemet's membrane and a soft eyeball. O'Brien[50] believes that this complication is usually caused by low intra-ocular pressure which produces congestion of the uveal vessels and rapid transudation of fluid from the choroidal vessels into the suprachoroidal lymph spaces. In a discussion of O'Brien's

paper, Reese[51] states that if the detachment were due to the lowered pressure of the eyeball and the relative increase in pressure of the thin-walled vascular channels of the choroid, a more frequent occurrence of choroidal detachment following operations for glaucoma would be expected. Wilder stated that detachments of the choroid occur after any operation in which the tension of the eye is suddenly reduced. We have seen almost complete detachment of the choroid following iridocorneosclerectomy with iridencleisis with complete spontaneous reattachment. According to Knapp, detachment of the choroid cannot be entirely due to reduction in the tension of the eyeball, and secondary contraction of the vitreous must be present in these cases. Verhoeff prefers to call it a compressibility of the vitreous, meaning the readiness with which fluid can be expressed from the vitreous and its volume thereby reduced. This explains why detachment does not always occur when intra-ocular pressure is reduced.

Treatment. As the condition heals spontaneously no special treatment seems to be indicated. According to Manes,[52] cases in which detachment of the choroid occurs, recover more quickly than those in which it does not occur. Manes, therefore, has attempted to produce this complication by gentle pressure on the inferior segment with a strabismus hook.

VIII. GLAUCOMA COMPLICATING EXTRACTION

In this study of 1,004 cases of cataract extraction, glaucoma was present preoperatively in nine (3 per cent) of the intracapsular series and in twenty-seven (3.9 per cent) of the extracapsular series. When glaucoma occurs postoperatively in cataract cases, changes in the anterior segment can usually be found, i.e., position of structures, cells in the aqueous and cicatricial tissue. In the intracapsular and extracapsular extractions loss of vitreous occurred in eighty-eight patients (9 per cent) who did not have glaucoma. Of the thirty-six cases in which glaucoma was present loss of vitreous occurred in five (14 per cent). Four of these patients had extracapsular operations performed and one intracapsular extraction. Hemorrhage in the anterior chamber occurred in only one glaucomatous case (3 per cent), while the percentage of hemorrhages in the anterior chamber in the nonglaucomatous cases was 2.2 per cent. The postoperative visual results obtained in the intracapsular and extracapsular series are shown in Table VII.

Table VII
VISUAL RESULTS FOLLOWING CATARACT EXTRACTION COMPLICATED BY GLAUCOMA

Final Vision	Intra-capsular	Extra-capsular
20/20	..	1
20/30	..	2
20/40	1	2
20/70	..	1
20/100	..	3
20/200	..	1
5/200	..	1
8/200	..	1
Hand movements	2	2
Fingers	..	2
Light projection	1	
Eye lost (tension 65)	1	
Vision not recorded	3	11
Not recorded in case of hypopyon	1	
Total	9 (3%)	27 (3.9%)

Discussion of Table VII. The visual results varied from 20/20 to light perception. In addition one eye in the intracapsular group was lost. A comparison of the two procedures reveals that the visual results following extracapsular extraction were apparently better than those following the intracapsular method.

Extracapsular extraction is the operation of choice in the majority of cases, when the limits of normal tension of the eyeball are exceeded, allowance being made for the rigidity of the sclera (Friedenwald[53]). It is usually advisable to perform a preliminary iridectomy or iridocorneosclerectomy[54] if hypertension is not controlled by miotics, followed by extracapsular extraction several months later. The time for

operation depends upon the progress of the glaucoma as indicated by the visual field, tension and pupillary reactions. How long the increased pressure has been present and whether the onset of raised tension was sudden are important points to be considered because the eye can apparently adapt better to increased intra-ocular pressure that develops slowly. Before operation, arteriosclerosis with hyperpiesis should be treated.

A case is reported by Davis[55] in which intra-ocular tension was lowered from 60 to 0 during avertin anesthesia. Therefore, this method of anesthesia should be considered in highly nervous or apprehensive patients with glaucoma complicating cataract extraction. However, we have had considerable success in reducing tension preoperatively by means of a retrobulbar injection of procain (2 per cent) combined with a 1:1000 solution of adrenalin. If this fails, a posterior sclerotomy is performed, a large conjunctival flap is prepared and sutures partially introduced. A keratome incision is made so that pressure may be slowly reduced and the wound is enlarged with scleral scissors. "Evipal" intravenous anesthesia was used in one case of our series with good results.

IX. DIABETES COMPLICATING CATARACT EXTRACTION

Diabetes is another general complication which is frequently encountered. In the intracapsular series it was present preoperatively in thirty-nine cases (13 per cent). In the extracapsular group, diabetes was a complication in 109 cases (16 per cent). (Table VIII.)

Vitreous was lost in eighty-three (9.9 per cent) of the patients who did not have diabetes, while in the diabetic patients vitreous was lost in ten (7 per cent). Hemorrhage in the anterior chamber occurred in four (3 per cent) of the 148 diabetic patients, while hemorrhage in the anterior chamber occurred in twenty-two (2.2 per cent) of the 1,004 patients.

Iris hemorrhage at the time of cutting the iris, and on the third or fourth postoperative day from iris or retinal vessels may be multiple and small in diabetics. Furthermore, there seems to be in debilitated individuals a great tendency to the development of low grade iritis which persists and may progress to iridocyclitis, especially if much trauma or any complications have occurred.

TABLE VIII
VISUAL RESULTS FOLLOWING CATARACT EXTRACTION IN DIABETIC PERSONS

Final Vision	Intracapsular	Extracapsular
20/15	1	
20/20	4	4
20/25	1	
20/30	4	9
20/40	12	25
20/50	4	9
20/70	5	15
20/100	..	3
20/200	3	12
Fingers	..	1
Hand movements	..	2
Not recorded	5	29
Total	39 (13%)	109 (16%)

Discussion of Table VIII. A comparison of the visual results obtained following the intracapsular and extracapsular methods in diabetic patients reveals that the results were approximately the same. It must be remembered, however, that the number of extracapsular cases was approximately four times as great as the number of intracapsular cases and that the intracapsular operation was often avoided in complicated cases.

Experience has shown that satisfactory results can be obtained following cataract extraction in diabetic patients if proper care is taken. According to Wilder[56] complete control of the glycosuria is not essential and the results of operation for cataract in diabetic patients are as good as the results in nondiabetic patients. Most authorities, however, still believe that complications are more frequent in diabetic patients than in nondiabetic patients. Fox[57] believes that diabetes is not the cause of most cases of cataract. Since cataract

seldom occurs in young persons with diabetes, it is assumed that senility is the greater factor. The conclusions are drawn by Waite[58] that senile and complicated cataracts occur with approximately equal frequency in diabetic and nondiabetic patients.

Wheeler[59] in a study of 2,123 extractions of cataract performed at the New York Eye and Ear Infirmary found that hemorrhages occurred in 28.94 per cent of the diabetic patients while the average incidence was only 5 per cent in cases of uncomplicated cataract. Ballantyne[60] noted that hemorrhages which occur in patients with diabetes are extremely slow in absorbing. Benedict[61] operates for cataract on chronic diabetic patients who have been prepared by one or two weeks' observation of diet with added protamine insulin. He has not seen repeated hyphemia with the new insulin preparation as he did with the old insulin. We agree that reduction of the sugar content of blood and urine to its minimum should be attempted by means of diet, but if hyperglycemia is not controlled by these methods, insulin should be administered.

In diabetic patients with ocular hemorrhages it has been found by Friedenwald and Gichner[62] that capillary fragility as tested by a blood pressure cuff at 100 mm. of mercury for three minutes is increased, whereas in diabetes with no ocular hemorrhages, capillary fragility is in general normal. Such increased capillary fragility is characteristic of scurvy, and the vitamin C metabolism of these patients was studied. In some instances an abnormality of the vitamin C balance was found but this is not regularly the case, and these authors do not now believe that vitamin C is concerned in this hemorrhagic tendency. The cause of the increased capillary fragility remains obscure.

SUMMARY TO PART II

1. Loss of vitreous apparently occurs more frequently in intracapsular extraction of cataract than in extracapsular.

2. There was a higher percentage of hemorrhages in the intracapsular group of cases.

3. Expulsive hemorrhage occurred in 0.7 per cent of the intracapsular series and in 0.43 per cent of the extracapsular series.

4. Although detachment of the choroid was observed in only one case (intracapsular extraction), certain surgeons believe that it occurs in almost all cases at the time of operation.

5. The visual results in cases in which glaucoma was present preoperatively were better following extracapsular extraction. A comparison of the percentage of hemorrhages in the anterior chamber occurring in the intracapsular and extracapsular series of cases and the percentage occurring in the glaucomatous cases revealed a slightly higher incidence in the glaucomatous patients. This was also true in regard to the amount of vitreous lost. In the glaucomatous cases loss of vitreous occurred in 3 per cent, while in the nonglaucomatous patients the percentage of cases in which vitreous was lost was 2.2 per cent.

6. Following intracapsular and extracapsular extraction of cataract in diabetic patients, the visual results and other complications were approximately the same as in cases uncomplicated by diabetes. Hemorrhage in the anterior chamber occurred in four (3 per cent) of the 148 cases of diabetes, while the percentage of hemorrhage in the anterior chamber in the 1,004 cases was 2.2 per cent. The preoperative administration of vitamin C and B seems to be rational therapy. Contrary to expectation vitreous was lost in only 7 per cent of the diabetic cases and in 9.2 per cent of the 1,004 cases.

7. Following is a summary of some of the points which should be considered in the prevention of immediate complications of cataract extraction: (a) Careful preoperative study of the patient and the administration of appropriate treatment. There were fewer postoperative inflammatory complications following the intracapsular operation and these statistics have been

reported. This fact must be considered in evaluating the two methods. (b) If tension is elevated preoperative reduction of intra-ocular pressure by miotics or operation followed by extracapsular extraction; if intervention is urgent posterior sclerotomy may have to be performed as a preliminary measure if avertin or a retrobulbar injection of procain and epinephrine hydrochloride, fails to lower tension. (c) Preoperative lowering of general blood pressure by rest and other means and if retinal blood pressure is known or believed to be elevated, lowering the intra-ocular pressure by injection of the ciliary ganglion at operation. (d) Extracapsular extraction in cases of increased tension within the vitreous. (e) Obtain complete anesthesia and akinesia of the eyelid and eyeball: eyelid and retrobulbar injections in all cases combined with a subconjunctival injection of procain. (f) Insure a perfect section well protected by properly introducing the Graefe knife and by obtaining a complete conjunctival flap. (g) Prevention of injury to the iris by complete anesthesia, withdrawing the knife if the point engages the iris and by making a small incision with a curved or scimiter-shaped cataract knife or hollow ground keratome if the anterior chamber is shallow; followed by enlargement of the wound. (h) Sutures which may be quickly tightened should be in placed before the lens is extracted and should be tied before the anterior chamber is irrigated or the iris respositor is used. (i) The incision should be large enough to prevent any undue pressure on the eyeball in expressing the lens. (j) Be sure to perform complete discission of the anterior capsule or if capsule forceps are used grasp the anterior capsule near the equator where it is thickest first below and then above with only a narrow bite. (k) Avoid excessive pressure with fixation forceps when making the incision. (l) Eliminate undue pressure and traumatism throughout the operation. (m) Prevent sudden movement of the eyeball by inserting a suture in the superior rectus after producing anesthesia with a subconjunctival injection of 2 per cent solution of procain. (n) Complete or peripheral iridectomy to prevent prolapse of the iris. (o) In diabetic patients control hyperglycemia by diet if possible so that the use of insulin may be discontinued for several weeks before operation. (p) In excessively nervous or irritable patients, consider the use of avertin or evipal anesthesia.

8. Finally, if this discussion stimulates renewed interest by ophthalmic surgeons in the causes of immediate complications of cataract extraction and more careful consideration of the means of prevention and methods of treatment, which may be employed, it will have served its purpose and should aid in reducing the amount of unnecessary postoperative blindness or lowered visual acuity.

We gratefully acknowledge the courtesy of the following ophthalmologists in allowing us to include a number of their cases in this report: Doctors Francis W. Shine, Bernard Samuels, Clyde E. McDannald, and the late Ben Witt Key and the late Webb W. Weeks.

REFERENCES

1. Van Lint, A. The Cataract Operations in "Senile Cataract." P. 123. Chicago, 1937. W. A. Fisher, H. G. Adair Printing Company.
2. Berens, C. Social service and follow up in ophthalmology. Conclusions after restudy of hospitals in New York and Brooklyn. *Tr. Am. Acad. Opbtb.*, p. 226, 1926.
3. Berens, C. and Taylor, M. K. Social service and follow up in ophthalmology. *Hospital Social Service*, 16: 89, 1927.
4. Berens, C. How can adequate medical social service be provided in eye clinics? *Hospital Social Service*, 22: 275, 1930.
5. Berens, C. The importance of social service and follow-up in preventing blindness. *Sight-Saving Review*, 2: 83, 1932.
6. Gifford, S. R. Allergic and toxic properties of lens protein. *Tr. Sect. Opbtb., A. M. A.*, p. 82, 1925.
7. Verhoeff, F. H. and Lemoine, A. N. Endophthalmitis phacoanaphylactica. *Tr. Internat. Cong. Opbtb.*, p. 234. Washington, 1922.
8. Berens, C. Certain postoperative complications of cataract operations. With particular reference to a study of one thousand and four operations. *Tr. Sect. Opbtb., A. M. A.*, 1938.
9. Berens, C. Sclerotomy scissors for enlarging corneal incisions. *Am. J. Opbtb.*, 22: 304, 1939.
10. Paton, R. T. Curved cataract knife and its advantages. *Arch. Opbtb.*, 14: 108, 1935.
11. Berens, C. A new keratome—a hollow-ground narrow angular keratome for paracentesis, iridocapsulotomy and iridotomy. *Tr. Am. Acad. Opbtb. & Otol.*, 1939.

12. Bulson, A. E. Prolapse of iris after cataract extraction. *Tr. Sect. Opbtb., A. M. A.*, p. 69, 1925.
13. Srinivasan, E. V. Rare complications in the operation for senile cataract. *Am. J. Opbtb.*, 19: 146, 1936.
14. Woodruff, H. W. Management of complications in the operation for senile cataract. *Am. J. Opbtb.*, 19: 146, 1936.
15. Hildreth, H. R. The fluorescent lamp for cataract surgery, *Am. J. Opbtb.*, 19: 770, 1936.
16. Bothman, L. Complications of cataract surgery in India. *Illinois M. J.*, 62: 243, 1932.
17. Greenwood, A. and Grossman, H. P. Analysis of 1,343 intracapsular cataract extractions by 48 operators following Verhoeff method. *Tr. Am. Opbtb. Soc.*, 33: 353, 1935.
18. Walker, C. B. Exactly appositional sutures in the cataract operation. *Tr. Am. Opbtb. Soc.*, 27: 51, 1929.
19. Arruga, H. Necessary attributes of a capsule forceps for cataract extraction. *Bull. Soc. franç. d'opbt.*, p. 205, 1934.
20. Walker, C. B. A modified capsule forceps for cataract extraction. *Am. J. Opbtb.*, 19: 794, 1936.
21. Markiewicz, S. Comments on the Arruga and Hess Forceps. *Klin. Oczna*, 14: 63, 1936.
22. Fisher, W. A. A new suction method for the intracapsular cataract operation. *Am. J. Opbtb.*, 15: 844, 1932.
23. Nugent, O. B. Complications in cataract extraction. *Am. J. Opbtb.*, 17: 135, 1934.
24. Green's Eye Hospital Bulletin of Practical Ophthalmology, San Francisco. The Modern Operation for Senile Cataract, 4: 18, 1934.
25. Gailey, W. W. A report on two hundred cataract operations. *Illinois M. J.*, 72: 528, 1937.
26. Berens, C. An untied suture for use in eye operations, particularly cataract. *Am. J. Opbtb.*, 8: 112, 1925.
27. Nugent, O. B. Complications in cataract extraction. *Am. J. Opbtb.*, 17: 135, 1934.
28. Parker, W. R. Comparative results in extraction of senile cataracts using combined, simple, and Knapp-Török intracapsular methods. *Arcb. Opbtb.* 11: 183, 1934.
29. Townes, C. D. One hundred attempted intracapsular operations. *Kentucky S. M. J.*, 34: 444, 1936.
30. de Grosz, E. Cataract extraction in 15,000 operations. *Arcb. d'opbt.*, 53: 161, 1936.
31. Greenwood, A. and Grossman, H. P. Analysis of 1,343 Intracapsular cataract extractions by 48 operators following Verhoeff method. *Tr. Am. Opbtb. Soc.*, 33: 353, 1935.
32. Knapp, A. Complications of forceps intracapsular operation for cataract based on analysis of 500 successive cases. *Arcb. Opbtb.*, 16: 770, 1936.
33. Bothman, L. Complications of cataract surgery in India. *Illinois M. J.*, 62: 243, 1932.
34. Gifford, H. On backing out of cataract operations. *Tr. Am. Acad. Opbtb.*, p. 171, 1920.
35. Dunphy, E. B. Loss of vitreous in cataract extraction. *Tr. Sect. Opbtb., A. M. A.*, p. 229, 1927.
36. Berens, C. An untied suture for use in eye operations, particularly cataract. *Am. J. Opbtb.*, 8: 112, 1925.
37. Berens, C. and Losey, R. R. An untied suture and conjunctival bridge in cataract extraction; results and conclusions. *Brit. J. Opbtb.*, 10: 576, 1926.
38. Blake, E. M. A conjunctival flap holder for cataract sutures. *Am. J. Opbtb.*, 17: 529, 1934.
39. Jensen, V. A. Hemorrhages into anterior chamber of the eye in cataract operations with and without employment of adrenalin. *Acta Opbtb.*, 10: 382, 1932.
40. Gailey, W. W. A report on two hundred cataract operations. *Illinois M. J.*, 72: 528, 1937.
41. Wright, R. E. Lectures on cataract, II. Difficulties at the time of cataract operation. *Am. J. Opbtb.*, 20: 119, 1937.
42. Abramowicz, I. The introduction of air into the anterior chamber in the course of cataract operation. *Ann. d'ocul.*, 167: 581, 1930.
43. Gifford, S. R. The prevention of complications in the cataract operation. *Illinois M. J.*, 68: 243, 1935.
44. Vail, D. Posterior sclerotomy as a form of treatment in subchoroidal expulsive hemorrhage. *Tr. Am. Opbtb. Soc.*, 1937.
45. Verhoeff, F. H. Scleral puncture of expulsive subchoroidal hemorrhage. *Opbtb. Rec.*, 24: 55, 1915.
46. Fuchs, E. Ablösung der Aderhaut nach Staroperation. *Arcb. f. Opbtb.*, 51: 199, 1900.
47. Barkan, H. Postoperative detachment of choroid: special reference to Elliot's operation for glaucoma. *Tr. Sect. Opbtb., A. M. A.*, p. 209, 1915.
48. Hagen, S. Serous postoperative detachment of choroid. *Klin. Monatsbl. f. Augenb.*, 66: 161, 1921.
49. O'Brien, C. S. Further observations on detachment of the choroid after cataract extraction. *Arcb. Opbtb.*, 16: 655, 1936.
50. O'Brien, C. S. Detachment of the choroid after cataract extraction. *Arcb. Opbtb.*, 14: 527, 1935.
51. Reese, A. B. Discussion of Dr. O'Brien's paper on detachment of the choroid after cataract extraction. *Tr. Am. Opbtb. Soc.*, 33: 336, 1935.
52. Manes, A. J. Experiences in 280 intracapsular extractions. *Arcb. de Oftal. de Buenos Aires*, 5: 382, 1930.
53. Friedenwald, J. S. Contribution to the theory and practice of tonometry. *Tr. Ass. Res. Opbtb.*, June, 1937.
54. Berens, C. Iridocorneosclerectomy for glaucoma. *Am. J. Opbtb.*, 19: 470, 1936.
55. Davis, F. A. Tribromethanol (avertin) as an anesthetic in eye surgery. *Am. J. Opbtb.*, 15: 208, 1932.
56. Wilder, R. M. Symposium on ocular complications of diabetes. *Arcb. Opbtb.*, 12: 144, 1934.
57. Fox, L. W. Causes of failure in ophthalmic operations. *Arcb. Opbtb.*, 3: 695, 1930.
58. Waite, J. H. and Beetham, W. P. The visual mechanism in diabetes mellitus. *New England J. M.*, 212: 367 and 429, 1935.
59. Wheeler, J. M. Hemorrhage into anterior chamber subsequent to operations for hard cataract. *Tr. Am. Opbtb. Soc.*, 14: 742, 1916.
60. Ballantyne, A. J. and Lawson, A. Discussion on senile cataract. Pre- and postoperative management and complications. *Tr. Opbtb. Soc. U. Kingdom*, 52: 74, 1932.
61. Benedict, W. L. Personal communication, April 28, 1938.
62. Friedenwald, J. and Gichner, M. G. Personal communication, March 12, 1940.

PREVENTION OF DISCOMFORT AND DISABILITY IN THE TREATMENT OF VARICOSE VEINS

I. A. BRUNSTEIN, M.D.

Chief of Varicose Vein Clinic, Stuyvesant Polyclinic; Assistant Physician, Peripheral Vascular Clinic, Gouverneur Hospital

NEW YORK, NEW YORK

THE disturbing sequelae, such as pain, discomfort and disability often encountered in the treatment of varicose veins, have been a problem to the physician. To prevent these unpleasant complications, I have found it feasible to adopt the technical and precautionary measures herein outlined. It is unfortunate that many patients refuse treatment for their varicosities, because they have experienced a painful treatment or they have been forewarned by relatives, friends and even physicians about the unpleasant and hazardous nature of this treatment. Untreated varicose veins almost invariably lead to complications such as dermatitis, phlebitis and ulceration and are often the cause of untold suffering and financial hardship. If the patient is assured that treatment can be effected with minimum discomfort and optimum therapeutic and cosmetic results, he will be willing not only to undergo active treatment for the correction of complications, but also will be amenable to prophylactic treatment.

ACCEPTED METHODS OF TREATMENT

It is not within the scope of this article to discuss indications and contraindications to active treatment, the various tests to evaluate the venous circulation of the lower extremities or the technic of ligation. These are subjects which have been adequately presented in recent textbooks and medical journals. However, a short review of the modern method of varicose vein treatment is in order.

Present day treatment of varicose veins is based on the efficiency of the injection treatment alone and injection treatment combined with surgical procedures. The latter procedure yields more satisfactory results at present because of the better understanding of the principles of ligation. From 1920 to 1930, as improved and safer irritant solutions became available, the sclerosing therapy for varicose veins was widely acclaimed as the perfect solution to the problem. Surgical measures declined and were considered antiquated. However, the inadequacy of injection treatment alone for all cases of varicosities soon became apparent to the great majority of physicians. Numerous reports appeared on the high incidence of recurrence of varicosities after sclerosing therapy alone had been used.

At present, division of the great saphenous vein at its junction, with resection of all important collaterals is considered indispensable in the treatment of varicosities in all cases in which incompetency of the saphenous system can be demonstrated. This method has greatly reduced the incidence and severity of recurring varicose veins. Adams[1] advocates high ligation in all cases of varicosities in which the valves are incompetent to the effects of any increase of intra-abdominal pressure such as that caused by coughing or straining, even though these valves may be competent to simple gravity effects. Although ligation is a very important part of the treatment, it is not sufficient in itself. Failure to complete the sclerosis will result in local varicosity at first, but sooner or later the ectasia will progress to more and more branches with possible involvement of communicating veins. Therefore, adequate postoperative injections of all remaining unsclerosed

varices are necessary to attain good end results.

Ligation is not indicated in all varicose conditions. Incipient varicosities and varices with no demonstrable backflow in the saphenous system should be treated by injection alone. A large proportion of patients, because of a nervous temperament, refuse ligation, but are willing to accept injection treatment alone. These patients should be given the benefit of sclerosing therapy, even though the results may be only transitory. The same patients realizing the value of treatment often discard their prejudice against surgical measures to obtain more permanent results. Regardless of the method of treatment, we cannot promise permanent freedom from varicose veins, especially in the presence of vulval or suprapubic varicosities; but we can assure our patients that they will avoid suffering and disability if they do not neglect their condition.

TECHNIC OF INJECTION TO PREVENT EXTRAVASATION AND SLOUGHING

Extravasation resulting in complications such as painful perivenous edema, induration and sloughing is almost without exception due to faulty technic. A large number of patients refuse treatment for fear of these unpleasant complications. It is my belief that this grave situation is avoidable. While the absence of serious allergic reactions in my patients may be due to fortuitous coincidence, I cannot attribute the absence of induration and sloughing during the past five years to good luck alone. I am quite certain that the following technical procedures have been instrumental in preventing extravasation and sloughing:

1. Avoidance of puncturing an indurated, pigmented, or eczematous area by starting the injection in healthy tissue.

2. Fixation of the vein to prevent its transfixion or its displacement by the needle. This is best done by exerting with the thumb an upward pressure on the overlying skin. After introduction of the needle into the vessel lumen, the vein is not likely to roll away from the needle upon release of an upward pressure, but such a situation is apt to occur after release of a downward pressure on the skin.

3. Introduction of the needle parallel to the longer axis of the varicosity and selecting from a cluster of varices the varix with the greatest diameter will also help to avoid transfixion of the vessel.

4. Avoiding transfixion of small invisible subcutaneous varicosities when approaching a large varix with the needle; these can be revealed by careful palpation of the area.

5. Insertion of the needle at about one-third of an inch from the vessel to avoid puncture of the skin over the varix. This is imperative when injecting superficial, intracutaneous, bluish varices covered by only a thin layer of atrophic skin. It is obvious that necrosis and sloughing will result from contact of an irritant solution with the weakened tissues surrounding the puncture. Injection into collapsed veins (empty vein technic) necessitates the introduction of the needle at a distance from the varicosity.

6. Avoidance of dislodging the needle while pressure is exerted on the plunger. This is best effected by firm but gentle pressure of the fingers supporting the syringe on the extremity. This precaution will anchor the needle within the vessel lumen and prevent transmission of the force exerted on the plunger to the needle.

7. Avoidance of overdistending the varix with sclerosing solution. Increased resistance to the introduction of solution with visible bulging of the injected varix is a warning signal to discontinue the injection.

The use of needles of small gauge (No. 25 or 26, ¾ to ⅝ inch long) will facilitate firm anchorage in the vessel lumen and prevent leakage of sclerosing solution into the surrounding tissues.

PREVENTION OF PAIN AND DISCOMFORT

In the treatment of varicose veins, it is necessary to eliminate pain and discomfort since they often result in disability. Toward this end the empty vein technic will be

found very helpful. In this type of therapy, the physician must obtain and retain the patient's confidence in order to assure continuance of the treatment. It is also important to keep the patient ambulatory and competent to pursue his usual activities during the course of treatment.

It is true that full vein injections will give maximum engorgement with ease of injection for the operator. This technic, however, will also result in maximum gross thrombus formation with the appearance of painful, hard, nodular masses and extensive edema in the perivenous tissues. The resulting pain and discomfort and the red indurations protruding in the form of unsightly strings or knots, often the cause of ambulatory limping, do not encourage the patient to continue treatment. The distress accompanying such massive thrombosis is frequently beyond the tolerance of the more sensitive patient and forces him to bed, thereby increasing the possibility of embolism. Our promise that treatment will be ambulatory is thus nullified. Large thrombosed veins are very slowly absorbed and are often the seat of recanalization. The avoidance of severe inflammatory changes in the perivenous tissues is also desirable to maintain these tissues in a fair state of integrity, should further treatment for possible recurrences be necessary. Even if the only advantage of the empty vein technic lay in the avoidance of pain and discomfort, it would seem sufficient reason to advocate it ardently.

However, there are other desirable advantages in employing the empty vein technic. Sclerosis by injection into empty veins will cause blocking of the varices by fusion of the opposing surfaces of the vessel and not by gross thrombosis. Direct contact of the intima with the chemical irritant, only slightly diluted by blood, produces a severe degree of irritation of the endothelium followed by an ample production of fibroblasts. The latter are instrumental in binding the opposing surfaces of the vessel firmly, as brought out by Al Akl.[2] Recanalization of such closed channels is less likely since they undergo organization and absorption more readily. The difficulty of obliterating resistant varicosities and the hazard of closing so-called blood lakes are also greatly reduced by the use of empty vein injections.

The disfiguring nature of varices is embarrassing to most patients and often is the only factor prompting them to undergo treatment. Undoubtedly, the results following injections into empty veins are more gratifying from the standpoint of cosmetic appearance. Adequate compressive collapse, as will be brought out, is also essential to obtain better cosmetic results. Discoloration, so objectionable to many patients, is greatly reduced following empty vein injections.

The main objection to the employment of the empty vein technic lies in the theoretical rather than the actual possibility of sclerosing solution escaping through communicating veins into the deep venous circulation, with eventual damage to it. Since several authorities (Unger,[3] 1927; Sedwitz, Steinberg,[4] 1938) use large amounts of a rather strong irritant solution for the retrograde segmental injection, which really is an injection into empty veins, this objection cannot be substantiated (Pratt,[5] 1939, uses 20 to 60 cc. sodium ricineolate). Comparatively small amounts of sclerosing solution, ¼ to 3 cc. are required in the empty vein technic since dilution of the irritant by blood is reduced to a minimum.

For this reason, in my opinion, the use of the empty vein technic does not increase the hazard of allergic reaction from sensitivity to the injected drug. It is difficult to explain why I have not encountered any serious allergic manifestations up to the present time. This may be due either to the constant practice of employing several very small initial doses of any solution I choose to inject, or to fortunate coincidence. However, it appears that these favorable results are definitely related to the administration of small doses of solution with the empty vein technic. Thus, the sudden introduc-

tion into the general circulation of a massive dose which might precipitate an allergic reaction is avoided. In view of the above mentioned distinct advantages, I consider the empty vein technique not only the technic of choice, but in several instances to be cited later, the technic of necessity.

The technical difficulty of injecting collapsed varicosities is its only disadvantage. This can be inferred also from the chapters on technic in recent textbooks on the management of varicose veins. Ochsner-Mahorner[6] state in "Varicose Veins": "One may have his own variations in technic but will learn quickly that nothing brings the varicosities into prominence so promptly or so distinctly as having the patient stand." Riddle[7] writes in "Injection Treatment": "The author uses all three positions, but as a rule employs the standing position. The operator will find it very convenient if the patient stands upright on the examining table."

Several of the technical procedures that I have found very helpful in overcoming the difficulties of the empty vein technic are presented here. These should be of particular interest to the beginner to encourage him to adopt suitable technic and to develop the necessary skill. Methods of technic must be varied and individualized to suit the different veins in individual patients. The operator may employ suitable modifications such as the use of rubber tourniquets, digital manipulations to empty varicosities or placing the patient on an inclined cushion.

EMPTY VEIN TECHNIC

Initial injections are best made in isolated superficial veins of the leg, using small doses of sclerosing solution to avoid unpredictably severe reactions. Quite often one will find that only small amounts are necessary to produce clinical results, thereby avoiding pain and discomfort which would result from a larger dose. I consider a reaction satisfactory when the patient complains of little or no pain and of only slight soreness on pressure over the occluded varix. The use of small initial amounts will help to avoid an acute flare-up of unrecognized latent phlebitis often associated with varicose veins as a result of the stagnating venous circulation. The degree of reaction to a small amount of sclerosing solution will indicate the state of vulnerability of the intima to the irritant and will help determine the optimal dosages for successive injections. These are gradually increased if no sign of sensitivity to the chemical irritant is observed and if larger doses are necessary to produce a desired sclerosis. Increased surface temperature at the site of varicosities is an important indication to proceed carefully with sclerosing treatment. Otherwise, a migrating phlebitic reaction in distant varicosities with its accompanying local and general discomfort may result. I have observed massive thrombosis of extensive varicosities in the leg or thigh following the injection of a large initial dose of sclerosing fluid in a distant vein segment. Adequate compressive support and cold applications will relieve pain and keep the patient ambulant in the event of a severe reaction.

INJECTION OF LARGE VARICOSITIES

The position of the patient is important for successful empty vein technic. When the patient is in the recumbent position, large varicosities rarely collapse to such a degree that injection into them is unsafe. Frequently, elevation of the extremity and stripping of blood is necessary to empty large varicosities. Blood can usually be aspirated freely from such varices. One may proceed carefully with the injection even when blood has not been freely aspirated if, after 1 or 2 m. of solution have been injected, one can ascertain by careful palpation the absence of any induration which would result from extravasated fluid. Adequate compression is of primary importance to maintain large varicosities in a collapsed and well supported state after injection. The irritation of the vein walls caused by compressive collapse may also be

an additional factor for effective sclerosis. For compression a flat sterile gauze pad (Zobec 2 × 2 inches) and adhesive tape, will guard against the possibility of unsupported thrombosis caused either by a retrograde flow of solution or by a possible

A B

FIG. 1. A, extensive, tortuous varicosities in the kneefold impeding walking; B, after treatment. Ligation and subsequent injections resulted in cure. In the treatment of large sized varicose veins effective support is of primary importance for good immediate and end results.

1½ to 2 inches wide, is preferred. The adhesive strips should be sufficiently long to give effective compression and may encircle the entire leg. Care should be exercised to apply the adhesive with even pressure and to avoid extreme compression which might interfere with the deep circulation. In the presence of sensitivity to adhesive plaster, insertion of gauze strips between the adhesive and the skin is advisable. In certain cases, it is indicated to maintain support with the aid of an elastic bandage, such as the Ace bandage or with elastic adhesive strips.

It has been my experience that best cosmetic results are obtained not by confining support exclusively to the site of the injection but by supporting the uninjected proximal and distal varices as well. This migrating phlebitic reaction and thereby will limit and often prevent possible massive thrombosis. The use of small strips of adhesive tape to secure a gauze pad covering the needle puncture is entirely inadequate. Firm support is a cardinal factor in effecting painless and good cosmetic results and, therefore, should be carefully considered by the physician. When adequate support is given to injected large varicosities, even the more sensitive patient remains ambulant during treatment with few or no complaints. (Fig. 1.) Firm support is especially desirable when varicose veins around the ankle are treated, as there is usually considerable swelling following occlusion of varicosities at this site.

INJECTION OF SMALL VARICOSITIES

When the varices are of smaller caliber and covered by a thicker layer of subcutaneous fat, injection with the patient lying down may not be safe. The following maneuvers will be found helpful to render such veins as nearly empty as possible. One or more adhesive strips 1½ to 2 inches wide are applied distally to the site of the proposed injection. These strips, serving as permanent tourniquets, block retrograde flow and permit the vein to collapse considerably. If the varicosity still remains markedly distended, I prefer to make the injection with the patient in a sitting posture, the leg hanging over the table margin. The needle is introduced into the vessel lumen and anchored securely. The leg is raised to a level sufficient to empty the vein and then supported on a chair or on the operator's knee; thus the injection is made into an empty vein. If the adhesive tourniquets produce minimum vein engorgement, injection of smaller varices can be made with the patient in a standing position. Gentle pressure with the needle on the posterior vein wall during the injection will also help to collapse the vein further. An attempt may be made to stretch tortuous or coiled-up veins and to maintain them in this state with adequate compression. The adhesive strips are left in place until the next visit to the office or they may be removed by the patient two or three days later.

To obtain optimum cosmetic results, dilated venules called spider web or hair veins, when associated with varicose veins, frequently may be safely injected with the patient lying down or in the sitting position. The key vein, associated with and feeding these ectasias, is intracutaneous and therefore in a rather fixed position and usually remains sufficiently engorged to permit safe introduction of a fine needle (27 gauge, ½ inch long). If the needle point is outside the vessel lumen, a wheal will appear before less than one drop of solution has been injected. If the needle is in the lumen, a characteristic blanching of the zone will appear due to sclerosing solution replacing the blood leaving the vein. Only slight pressure should be used for the injection of such venules in order to obtain minimum distention, since these small vessels rupture readily. Discoloration caused by the deposit of blood pigments, hematin and hemosiderin, in the perivenous tissues is frequently observed following injection of small veins. This is due to the great permeability of the thin, injured vein walls to sclerosing solution and blood pigments. Therefore, the employment of small amounts of weaker obliterative agents such as invertose 60 to 70 per cent or sodium psylliate, 1 or 2 per cent (sylnasol 5 per cent diluted with sterile distilled water) will lessen discoloration by producing a milder reaction in the vein walls, thereby reducing hemorrhagic extravasation in the perivenous tissues. The employment of weaker irritants for small superficial varicosities gives added insurance against the possibility of necrosis and sloughing following accidental extravascular infiltration. Here, too, firm compression applied immediately after injection is necessary to effect better cosmetic results.

NEED FOR THE EMPTY VEIN TECHNIC

While the empty vein technic may in general be considered the technic of choice for the effective and most pleasant eradication of varicose veins, it must be considered the technic of necessity in the following situations:

1. When injecting superficial, partially intracutaneous veins, and thin-walled, sacculated ectasias (vesicle veins). (Fig. 2.) These are of a more or less deep blue color, covered only by a thin layer of skin. When the patient is in the recumbent position, such vessels rarely collapse to such a degree as to make their injection unsafe. Full vein injection of such varicosities often results in thrombosis with the formation of painful, hematoma-like indurations protruding in the form of knots and strings. Such indurations are very slowly if at all absorbed. When this has occurred, removal of blood clots from such painful

thrombosed veins is often indicated to avoid suppuration resulting in irregular sloughing and scarring.

taneous fat, and full vein injections would, therefore, result in painful indurations which are usually very slowly absorbed.

A B C D

FIG. 2. A and C, subcutaneous sacculated ectasias (vesicle veins) rupturing spontaneously. A, blocking of the backflow in the incompetent great saphenous vein does not result in collapse of these superficial varicosities. B and D, after treatment. These superficial varices can be injected safely only when they are in a collapsed state.

2. In varicosities over bony prominences, as over the anterior surface of the tibia, the patella and about the ankle bones. In these areas there is only a thin layer of subcu-

3. When injecting varicosities in or near areas of chronic thrombophlebitis, dermatitis hemostatica, varicose eczema, psoriasis, etc. These complications, caused or ag-

gravated by the stagnating venous circulation, are frequently exacerbated by gross thrombosis and the resulting perivenous edema. In the presence of chronic thrombophlebitic induration the employment of iontophoresis with mecholyl, as described by Kovacs,[8] will be found helpful to soften such hardened areas before sclerosing therapy is instituted. It is advisable first to inject varicosities situated at a distance from these hard, nonpitting, brawny indurations. After softening with mecholyl iontophoresis, one will frequently find several medium or small-sized varices within the thrombophlebitic area. This group must be injected with the greatest care, the best approach being from without the margin of the thrombophlebitic area. The latter usually remains somewhat pigmented, though considerably lighter in color, even after treatment.

4. Impairment of arterial circulation is considered by some workers a contraindication to active treatment, while numerous others believe that the defective arterial supply will be greatly improved by the elimination of associated incompetent veins.

In the presence of an incompetent internal saphenous system, venous ligation is the method of choice. Excessive thrombosis is to be avoided as the deficient arterial circulation may be inadequate to cope with an extensive local reaction and perivenous edema. When the elimination of such varicosities by injection is desirable, minimun doses of sclerosing solution into empty veins are indicated for safety.

As for choice of sclerosing solutions, I have at present no new experiences to add to the data already presented in a recent publication.[9] I have continued the use of sodium morrhuate 5 per cent without encountering any untoward reactions.

TECHNICAL PROCEDURES EMPLOYED WITH LIGATION AND THE RETROGRADE INJECTION

The advantage of combining ligation with a simultaneous retrograde injection of the great saphenous vein lies in the fact that it will greatly reduce the number of injections required in the follow-up treatment. In many patients the upper segment of the saphenous vein is also most difficult to inject from the surface of the thigh. In the presence of infected ulcers complicating varicose veins, active treatment should be delayed until the infection is under control. Azochloramide in triacetin 1:500 will be found very effective for the treatment of moist superficial ulcerations. The astringent action of this solution will also shorten the healing time. The duration of action can be prolonged by covering the medicated dressing with an impermeable material such as waxed paper or oil silk to prevent absorption by the overlying dressing. The employment of gentian violet 2 per cent in aqueous solution, followed by a bismuth powder, and the use of a nonadherent dressing material are also efficacious in the treatment of superficial ulceration. Adequate support of the superficial venous circulation is of primary importance to accelerate control of infection and epithelialization.

The following procedures will be found helpful to make ligation an uneventful minor operation with minimum postoperative pain and discomfort and will insure better cosmetic results. Before ligating, several small injections into isolated varicosities should be given to ascertain whether or not the patient is sensitive to the solution to be used for the retrograde injection, and to determine, by observation of the degree of reaction and sclerosis following these injections, the optimum amount of solution for the distal injection. If the reactions are severe, the presence of latent phlebitis is to be suspected. Should this occur, it is best to delay ligation and to continue injection treatment with small repeated doses of weaker sclerosing solutions, gradually increasing the amount. This will produce successive, acute phlebitic reactions of a localized and mild nature. The effect of these graduated phlebitic reactions is similar to the action of increasing doses of autogenous vaccines. By the use of these measures, one will

prevent severe secondary thrombophlebitic reactions in the distal segment of the severed vein and surrounding varicosities. Such a reaction occurs from six to eight days after the operation and is usually accompanied by severe local and systemic discomfort.

SUPPORT OF THE THROMBOSED VEINS

Adequate support will greatly reduce postoperative pain and discomfort and will keep most patients ambulant. This support is best applied immediately before the operation and should be continued until subsidence of the swelling and pain. An elastic bandage, such as the Ace bandage, Ace lastex bandage or a similar bandage, applied firmly from toes to knee while the patient is in a recumbent position, will secure effective compression of the varicosities of the leg. In the presence of varicose eczema or dermatitis hemostatica, a zinc gelatin bandage such as cruricast is preferable. An elastic adhesive bandage, such as the Ace lastex bandage will also secure firm support, especially in the presence of edema, but it should be applied only on healthy skin. Areas of skin lesions, such as secondary weeping eczema or dermatitis, should be covered with a cod liver oil ointment or a mild tar product and gauze before the application of an adhesive bandage. A nonadherent covering such as oil silk or strips of waxed paper over the medication will help protect new granulations and epithelialization.

Adequate support of the great saphenous vein and the surrounding varicosities of the thigh is best attained by the application of a nonslipping support such as adhesive strips or an elastic adhesive bandage. This support should be applied with even pressure avoiding strong tension. It is advisable to unroll the elastic bandage for about ten inches before applying, to avoid compression of the thigh by the force used to unroll the bandage. Dr. Tunick[10] makes the retrograde injection after the extremity has been slightly elevated. To prevent leakage from the puncture hole, a needle of small gauge is preferable for this injection.

An endeavor was made to keep the "before and after treatment" illustrations similar both in size and tone gradation, as only then are they useful for clinical evaluation.

CONCLUSIONS

1. Treatment of varicose veins can be effected with a minimum of pain, discomfort and disability. In a high percentage of cases, ligation is essential for effective treatment. The empty vein technic, though more difficult from a technical point of view, will greatly contribute to good end results.

2. Adequate compressive support (compressive collapse) is of primary importance to achieve painless sclerosis and good cosmetic results.

3. Methods of technic must be varied and individualized to suit the different veins in individual patients.

4. Overtreatment is to be avoided since it usually leads to insufficient treatment, as the patient, discouraged by distressing sequelae, gives up treatment at an early stage.

5. It is desirable and possible to obtain good cosmetic results, not a negligible factor in the treatment of varicose veins.

REFERENCES

1. Adams, J. C. Etiological factors in varicose veins of the lower extremity. *Surg., Gynec. & Obst.*, 69: 717–725, 1939.
2. Al Akl, F. M. *Med. Rec.*, 149: 46, 1939.
3. Unger, E. Zur Technik der Varicenbehandlung. *Zentralbl. f. Chir.*, 54: 3273–3274, 1927.
4. Sedwitz, S. H. and Steinberg, M. H. Sclerosing of varicose veins by ligation and one massive injection of sodium ricinoleate (soricin). *Am. Heart J.*, 15: 671–680, 1938.
5. Pratt, G. H. Segmental sclerosis of the saphenous vein for varicose veins, ulcers and diminished arterial supply. *J. A. M. A.*, 113: 925–927, 1939.
6. Ochsner, A. and Mahorner, H. R. Varicose Veins. P. 113. St. Louis, 1939. C. V. Mosby Co.
7. Riddle, P. Injection Treatment. P. 131. Philadelphia, 1940. W. B. Saunders Co.
8. Kovacs, J. Iontophoresis of acetyl-beta-methylcholine chloride in treatment of arthritis and peripheral vascular disease. *Am. J. M. Sc.*, 188: 32-36, 1934.
9. Brunstein, I. A. The management of varicose veins in private practice. *New York State J. Med.*, 40: 918–927, 1940.
10. Dr. Tunick. Personal observation.

CONGENITAL DISCOID MENISCUS*

A CAUSE OF INTERNAL DERANGEMENT OF THE KNEE

EDWIN F. CAVE, M.D.
Assistant Visiting Orthopedic Surgeon,
Massachusetts General Hospital

AND

O. SHERWIN STAPLES, M.D.
Assistant in Orthopedic Surgery,
Massachusetts General Hospital

BOSTON, MASSACHUSETTS

CONGENITAL anomalies of the semilunar cartilages should always be kept in mind when attempting to make a differential diagnosis in a case of internal derangement of the knee. It is particularly true in children and adolescents. To date, a congenital anomaly of the meniscus has not been a very common finding. In 1889, it was first seen in an anatomical specimen and described by Young of Glasgow. It was not until 1910, however, that this anomaly was associated with symptoms of internal derangement of the knee. At this time Kroiss reported a disc-shaped external meniscus with a horizontal split (as in one of our cases: R. G. No. 5702, Fig. 3) which he had removed surgically. Since that time, cases of discoid semilunar cartilage with clinical symptoms have been reported in increasing numbers, beginning with Bristow's report in 1927. To date over fifty cases have appeared in the literature. All anomalies reported, as far as we could determine, were those of the external meniscus with one exception (R. Watson-Jones). The report of a completely disc-shaped internal meniscus has not been found in the literature.

Occurrence. Naughton Dunn reported eight cases of discoid type external cartilage occurring in a consecutive series of two hundred ninety-five cases of internal derangement of the knee; this proportion agrees with our findings. In a ten-year period at the Massachusetts General Hospital there were one hundred sixty-four patients operated upon for internal derangement of the knee. In this series there were four cases of congenital anomaly of the meniscus, an incidence of 2.4 per cent. To these four we have added in this report three cases in which the patients were operated upon by us.

Development. The embryological background of the disc-shaped meniscus has been previously discussed by Jaroschy, Fisher, and others. The lizard is the highest form in which the completely disc-shaped meniscus normally appears. Jaroschy believes that comparative anatomy studies throw little light on the occurrence of this anomaly in man.

Symptoms and Signs. Symptoms may begin at any age but are most apt to occur in children or young adults. The ages, in years, of our seven cases were: 8, 10, 10, 13, 19, 19 and 19, respectively, the average being fourteen years. The disability may follow a definite injury to the knee, severe or slight, or may begin without trauma. In five patients symptoms began with a definite injury and in only two was there no trauma. The outstanding complaint as a rule is a snapping sensation accompanied by an audible click, or thud or jar when the knee is flexed or extended. As a rule active motions more effectively produce this sound. This is sometimes associated with pain. Usually there is little reaction in the knee except after an acute episode causing an increase in joint fluid. Motions are frequently unrestricted. A palpable tender mass may be felt along the joint line and its prominence is exaggerated as the knee is brought from a flexed position to extension.

X-ray Findings. Roentgenograms are usually negative except perhaps for widening of the joint space between the external (or internal) condyles of the femur and tibia.

* From the Orthopedic Service, Massachusetts General Hospital.

Pathology. Of the cases reported in the literature almost half exhibited a split or tear or other form of injury constituting the mechanism by which pain or locking occurred. In the remaining cases, which showed no injury, the cause of snapping or locking was usually obscure. Middleton observed at operation a transverse ridge in the central portion of the meniscus which caused the jog of the knee as the femoral condyle rode over it in flexion and extension. This mechanism he demonstrated in two of his four patients operated upon.

In our cases we did not encounter the situation which Middleton described. Only two of the seven cartilages were free from injury. The snapping and pain in one of these was due to a transverse ridge in the external femoral condyle on the weight-bearing surface, which appeared to engage the thickened mobile meniscus during flexion and extension, and thus caused a jog and thud as the knee was moved beyond that point. (Case II, M. B.) In the other case, the snapping sensation and the audible click on motion of the knee were due to a combination of relaxed crucial ligaments and the thickened and broad meniscus.

In this series there are five anomalies of the external meniscus and two of the internal. Three external cartilages were complete discs; the remaining four were discoid in type but showed some evidence of semilunar shape.

Treatment. Internal derangement of the knee joint due to a congenital anomaly of the semilunar cartilage should be treated by excision of the cartilage whether it is damaged or not. In our series, five of the seven cases showed evidence of injury to the cartilage but all were relieved by excision. Usually removal of such structure presents no difficulty and can be accomplished with either the Fisher, Jones, or combined anteroposterior incisions.

CASE REPORTS

Case I. E. T. No. BM15105, age nineteen, a male, nine months before while playing football, was struck by a tackler on the outer side of the right knee. Swelling and pain followed, lasting two days. Brief locking of the knee had occurred several times since then. Since the injury he could produce snapping in his knee by flexing it with the leg held in external rotation.

Examination revealed slight atrophy of the thigh. No tenderness or masses were felt. There was no joint effusion and full range of motion was present. There was no increased lateral mobility but definite increased anteroposterior mobility, in 90 degrees flexion. Snapping of the knee could be produced by passive flexion with the leg held in external rotation. *X*-rays revealed an old fracture of the tibial spine.

The Fisher incision was used at operation. On opening the joint, the external semilunar cartilage was found to be thickened and formed a complete disc covering the external condyle of the tibia. The cartilage showed no evidence of injury. The crucial ligaments were relaxed but intact. The discoid cartilage was completely removed. The relaxation of the crucial ligaments and the discoid meniscus accounted for the patient's symptoms.

One year later the patient was symptom free with normal knee motions and full activity.

Case II. M. B. No. U78882, age ten, a female, six weeks before, without history of injury, began to have locking of the left knee which was easily reduced, but accompanied by pain on the outer side of knee. During this time there had been snapping on flexion and extension. There had never been swelling of the knee.

There was one-half inch atrophy of the thigh. Tenderness was present over the external joint line posteriorly. Examination revealed no joint effusion and full range of motion. No increased anteroposterior or lateral mobility were present. On flexing and extending the knee there was an audible thud accompanied by a jog of the tibia on the femur which could be seen and felt. This occurred at 30 degrees and again at 120 degrees flexion. *X*-rays were negative.

Operation was performed with a Jones incision. On opening the joint, a thick completely discoid external meniscus was seen. The cartilage was removed *in toto*. There was no split or evidence of injury. There was a prominent ridge on the external femoral condyle which impinged against the anomalous thickened cartilage and caused the snapping of the knee. One year postoperatively the knee was

normal and no symptoms were evident. *X*-rays were negative.

Case III. R. G. No. U57402, age nineteen,

Fig. 1. Case I. Complete discoid external semilunar cartilage; no damage to the meniscus.

a male gave no history of injury. Locking of left knee had occurred as long as he could remember. It always occurred in full flexion, could be released by pressing a protruding mass in the external tibiofemoral fossa and was accompanied by little or no pain. On a few occasions there was swelling and pain on the outer side of joint lasting a few days following minor strains.

Examination revealed a slight atrophy of the thigh; tenderness was present over the entire external joint line to a slight degree. A small firm mass appeared in the external tibiofemoral fossa on full flexion of the knee; this could be pushed back into the joint without pain. There was no joint effusion; full range of motion was present. *X*-rays were negative.

At operation the Fisher incision was used. The external cartilage was thickened and disc-shaped covering the entire external condyle of the tibia. The cartilage was removed *in toto*. There was a horizontal split in the cartilage involving the posterior two-thirds, dividing this portion of it into a superior and inferior layer. Full flexion of the knee would cause the superficial layer to roll forward (Fig. 3) and give rise to the locking and make the mass palpable.

Two years later the patient was symptom free. The knee was normal except for slight relaxation of the joint and slight quadriceps atrophy.

Case IV. A. A. No. U188663, age fourteen,

Fig. 2. Case II. Complete discoid external semilunar cartilage; no evidence of injury.

a male five months before entry while playing football fell striking his left knee on a cement walk. Pain followed immediately and persisted up to the time of admission. Since the injury his knee during active extension had frequently snapped and caught, but true locking had never occurred.

Examination revealed three-fourths inch atrophy of the thigh; tenderness over the external joint line anteriorly; slight joint effusion; permanent flexion of 5 degrees, otherwise normal joint motion. On extending the knee from a flexed position a tender mass became palpable in the external tibiofemoral fossa. There was no jog or audible thud accompanying it, and no increased anteroposterior or lateral mobility. *X*-rays were negative.

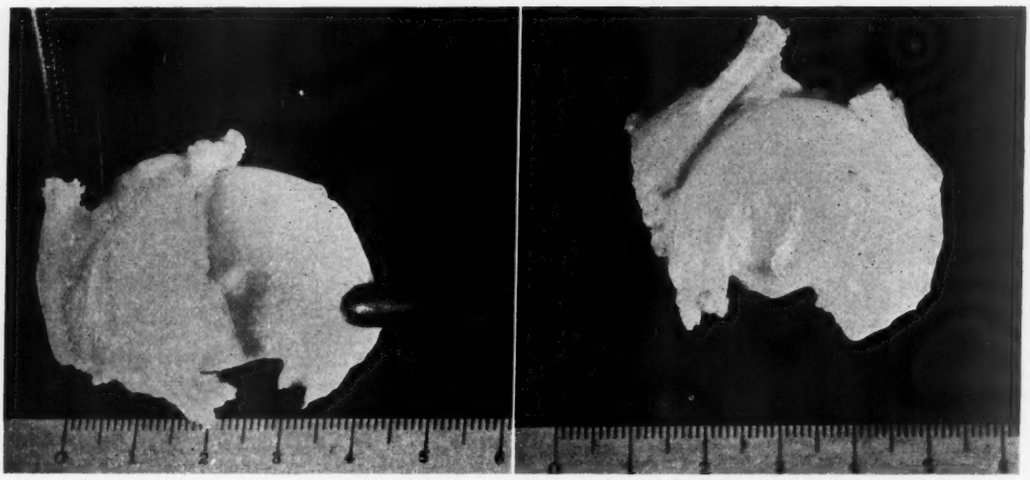
At operation the Fisher incision was employed. The external semilunar cartilage was thickened and of the discoid type, covering almost the entire surface of the external condyle of the tibia. It was removed *in toto*. Anteriorly, the inner margin of the cartilage was crescentic, and medial to it a portion of the external condyle of the tibia was exposed. Posteriorly, the cartilage was completely discoid and was split transversely. (Fig. 4.)

Ten months postoperatively the knee was symptom free. There was no quadriceps atrophy; the joint motions were normal and there was no instability.

Case V. J. L., No. U111104, age thirteen, a male, fell twisting his right knee two months

before entry. Pain persisted for one day. Five weeks before entry, when suddenly arising from kneeling position, he had pain in his knee,

At operation vertical anterior and posterior incisions were used. The internal semilunar cartilage was seen to be "twice or three times "



A B

FIG. 3. Case III. A, complete discoid external semilunar cartilage with horizontal split posteriorly. The superior portion is turned up and forward. B, shows split superior portion returned to its normal position.

accompanied by flexion deformity and swelling. These symptoms persisted until entry.

Examination revealed three-quarters inch atrophy of the right thigh; tenderness over the internal joint line anteriorly; no mass was felt. There was a slight amount of increased fluid in

as thick and as wide as normal, and contained a "bucket-handle" split. ("It was apparent that the cartilage was of the congenital discoid type.") The split portion, attached at both ends, had been dislocated into the intercondylar notch. The entire cartilage was removed.

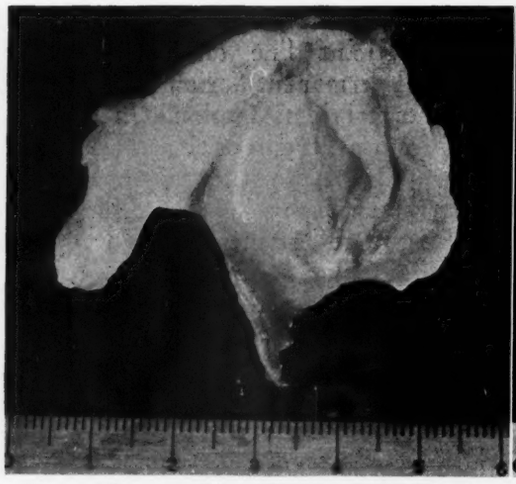


FIG. 4. Case IV. Discoid type external semilunar cartilage with transverse split in posterior portion.

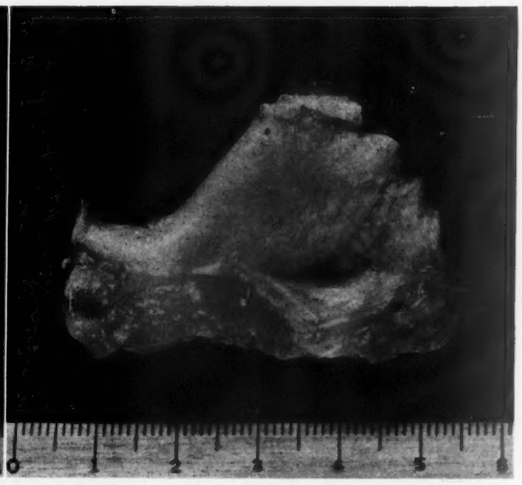


FIG. 5. Case V. Anomalous internal semilunar cartilage with a "bucket-handle" split; incompletely discoid in type with concave inner border.

the knee joint. Permanent flexion of 15 degrees with further flexion of 135 degrees. There was no increased anteroposterior or lateral mobility as compared with the opposite knee. No audible or palpable snapping was present. *X*-rays were negative.

Two years later the knee was symptom free; motions were normal, and there was no quadriceps atrophy or instability.

CASE VI. H. R., No. 342881, age eight, a male, four months before entry, injured his

right knee while playing football. There was pain for a few hours after injury but no locking. On the following day there was a second injury while playing football, followed by pain and flexion deformity. He was treated by rest and casts, with only partial improvement.

Fig. 6. Case vi. Partially discoid internal semilunar cartilage with a split at its anterior portion.

Examination revealed no atrophy of the thigh. A firm mass was felt in the internal tibiofemoral fossa. On flexion this mass disappeared within the joint. There was no tenderness and no joint effusion; there was 10 degrees permanent flexion and complete flexion. No increased anteroposterior or lateral mobility was present as compared with the opposite knee. *X*-rays were negative except for widening of the mesial joint space.

A Fisher incision was employed, exposing the internal semilunar cartilage; the cartilage was found to be torn at its anterior insertion. The cartilage was discoid in type covering the major part of the internal tibial condyle. It was entirely removed.

Two years later normal motion and full activity were present. No pain, no knee symptoms and no instability were present.

Case vii. M. C., No. PH37320, age nineteen, a male, while playing squash rackets, slipped and twisted his knee five months before entry. His knee locked. During the course of a month pain in the knee diminished, and motion gradually improved. Since then he has had a "popping" sensation on the outer side of the knee whenever he extended it.

Examination revealed no atrophy of the thigh. Tenderness was present over the entire external joint line; no mass was felt; slight joint effusion was present and full range of motion. In flexing and extending the knee a "thud" could be felt on the external side of the joint. *X*-rays were negative.

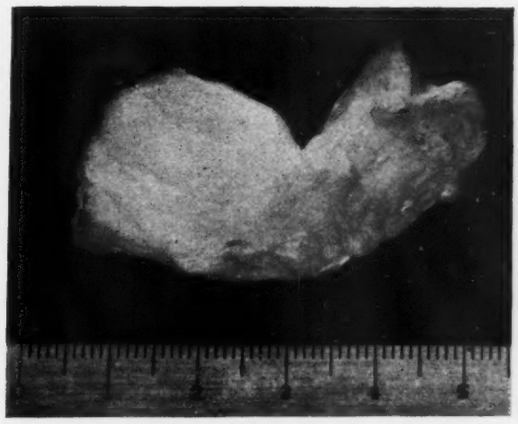


Fig. 7. Case vii. Incompletely discoid type external semilunar cartilage; transverse split present in its midportion.

Operation was performed using the Fisher incision. The external cartilage was abnormally thick and wide. The anterior four-fifths of the cartilage was removed. A transverse split was present in the midportion. The cartilage was of the discoid type although the external tibial condyle was not completely covered by it. The posterior portion especially was enlarged, being two to three times as wide as the ordinary cartilage.

Two months later the patient was symptom free. There was no increased joint fluid, no permanent flexion and no instability.

SUMMARY

Congenital discoid meniscus is not an uncommon cause of internal derangement of the knee. It occurs much more frequently in the external than in the internal compartment of the joint. It usually causes symptoms in childhood or adolescence, and an injury may or may not precipitate the difficulty. The symptoms and signs are those of internal derangement, and the treatment should be operative removal of the anomalous cartilage. The discoid member may or may not show signs of damage. The operative results are uniformly good.

REFERENCES

1. Kroiss, F. Die Verletzungen der Kniegelenkszwischenknorpel und ihre Verbindungen. *Beitr. z. klin. Chir.*, 66: 598, 1910.
2. Bristow, W. R. Anatomical variation of the semilunar cartilage. *Proc. Roy. Soc. Med.*, 21: 241, 1927.
3. Watson-Jones, R. Specimen of internal semilunar cartilage as a complete disc. *Proc. Roy. Soc. Med.*, 23: 1588, 1930.
4. Dunn, N. Observations on some injuries of the knee joint. *Lancet*, 1: 1267, 1934.
5. Finder, J. G. Discoid external semilunar cartilage —a cause of internal derangement of the knee. *J. Bone & Joint Surg.*, 16: 804, 1934.
6. Bell-Jones, E. The discoid or congenital abnormality of the interarticular fibrocartilage of the knee joint. *Liverpool Med. Chir. J.*, 43: 78, 1935.
7. Jaroschy, W. Der schiebenformige Meniscus lateralis genu als Ursache des schnellenden Knies. *Beitr. z. klin. Chir.*, 161: 139, 1935.
8. Fisher, A. G. T. The disc-shaped external semilunar cartilage. *Brit. M. J.*, 1: 688, 1936.
9. Middleton, D. S. Congenital disc-shaped lateral meniscus with snapping knee. *Brit. J. Surg.*, 24: 246, 1936.
10. Cave, E. F. and Roberts, S. M. A method of measuring and recording joint function. *J. Bone & Joint Surg.*, 18: 455–465, 1936.
11. Cave, E. F. Combined anterior-posterior approach to the knee joint. *J. Bone & Joint Surg.*, 17: 427–430, 1935.

Ankylosis of a joint or stiffness of the adjacent soft parts is due not to immobilization but to pathologic changes. Such changes in turn are due to irritation, inflammation, tissue destruction, and scar formation.
From—"Wounds and Fractures" by Orr (Charles C. Thomas).

CHRONIC SCLEROSING OSTEOMYELITIS: GARRÉ

D. Rees Jensen, M.D.
Associate Attending Surgeon, Knickerbocker Hospital
NEW YORK, NEW YORK

CHRONIC osteomyelitis is a disease which is being more frequently observed. There is considerable literature discussing the acute and chronic forms of osteomyelitis. However, the few papers which have appeared discussing the type described by Garré are evidence of its rarity. This unusual disease still presents a problem in diagnosis and treatment.

In 1893, Garré[3] discussed the disease which bears his name. The picture was that of dense sclerosis of bone without suppuration. Trendel[9] in 1,299 cases of osteomyelitis reported fifty-four, and Henderson[5] in a group of 1,968 described thirty cases. In another report of 559 cases, from the Tubingen clinic, twenty showed neither suppuration nor necrosis. There are infrequent references in the literature, and a few textbooks on surgery briefly mention the disease. Jones,[6] in 1921, reviewed the literature and presented a case of his own. Other writers particularly Bloodgood[2] and Geschickter and Copeland[4] have discussed the subject and the problems it presents.

ETIOLOGY

The disease has the characteristics of an infectious lesion although in some cases the infectious agent cannot be demonstrated. There is a low grade persistent irritation which results in fibro-osseous proliferation without suppuration. Wishner[10] reported a growth of Staphylococcus aureus in three out of five cases. Bennett and Hopkins[1] have reported a case in which Trichina were found in the muscle adjacent to the diseased bone. Whether the presence of this parasite in the soft tissues was sufficient to cause persistent irritation of the bone and sclerosis is problematical. Garré reported three out of four cases in which the Staphylococcus aureus or albus were isolated. Swett[8] reported two cases after fracture of the tibia, not compounded, in which the persistence of pain made a later operation necessary. Eburnated bone was found in each case at the site of the healed fracture. Removal of a section of cortex resulted in definite improvement. The microscopic sections showed, "focal necrosis of bone." No culture was reported. Staphylococcus aureus hemolyticus was cultured from the curettings of the bone in the case herein reported.

PATHOLOGY

The tibia is said to be the bone most often involved, and that it occurs in males more often than females. The femur was involved in the case observed by the writer. There is a low grade infection of the lymphatics of the bone. By Kaufmann[7] it is called "osteitis ossificans, condensing osteitis, or osteosclerosis." The lesion is usually solitary. It consists of a formation of new bone arising from the marrow cavity and vascular channels and encroaching upon the old trabeculae. The marrow cavity gradually becomes narrowed or obliterated, the cortex widened and its density increased to ivory-like consistency. With this osseous proliferation there is an increased fibrosis. (Fig. 5.)

SYMPTOMS

The following case illustrates the history, the signs and symptoms of the disease and a complication not presented heretofore in the cases reported:

Case Report. M. O., a female, age twenty-eight years, a secretary, had recurring pain in the elbows, wrists, fingers, right knee and ankle, for seven years. The patient began having pains seven years before in most joints, not constant

but with frequent recurrence. The pain was aggravated by activity and abated some with rest. Her physicians had at various times has chronic arthritis; one sister died of rheumatic heart disease; one aunt had arthritis, and her father died in 1940 of heart disease.

FIG. 1. Right femur (September, 1937): There is thickening of the cortex and medulla in the lower third. Periosteal irregularity with linear shadows of increased density in the soft tissues are present posteriorly. There is a multiple cystic appearance in the lower part which culminates in a large cystic area in the lateral condyle. With the exception of a small amount of squaring of the bony margin of the joint nothing else unusual is noted. Findings suggest osteomyelitis of Garré.

examined her and made the diagnosis of rheumatoid arthritis and appropriate treatment rendered. *X*-ray of teeth was negative for infection. Streptococcic agglutination was negative, sedimentation rate was 0.42.

In 1935, symptoms of low-grade recurrent appendicitis appeared. Operation was performed and an atrophic appendix removed with release of congenital adhesions of the cecum and lower ascending colon. In 1936, following an episode resembling "grippe," joint pains recurred with elevation of temperature to 100°F.

Her past history was negative for either chronic or acute infection, except for the above mild attack of "grippe." There was no history of trauma to the extremities. Tonsils had been removed at the age of seven years. Her mother

Examination was negative except as follows: swelling and tenderness about the right knee and ankle; no redness, increased heat or induration; there was tenderness to pressure over the condyles of the femur. The following was the result of the laboratory tests: white blood cells 6000–10,280; polymorphonuclears 60 per cent; lymphocyte 30 per cent; hemoglobin 82 per cent; red blood cells 4,250,000; sedimentation rate 0.3; streptococcic agglutination 1:1280 only. Serum studies: calcium 11.1; phosphorus 3.7; Wassermann blood test negative.

X-rays. All long bones and joints were *x*-rayed with the positive findings as follows: "Films of the right femur show thickening of the cortex and medulla in the lower third. There is some periosteal irregularity with linear shadows of increased density in the

Fig. 2. Right femur (September, 1938): This differs from the normal in that the fine trabecular markings are not made out; there is a diffuse density of moderate degree obscuring the lower fifth of this femur. The lateral cortex is rather rough and somewhat thicker than the left, and there is one drill hole visible. A surgical excavation can be seen extending from this region into the lateral condyle. These changes are characteristic of osteomyelitis, but the changes are only to a mild degree.

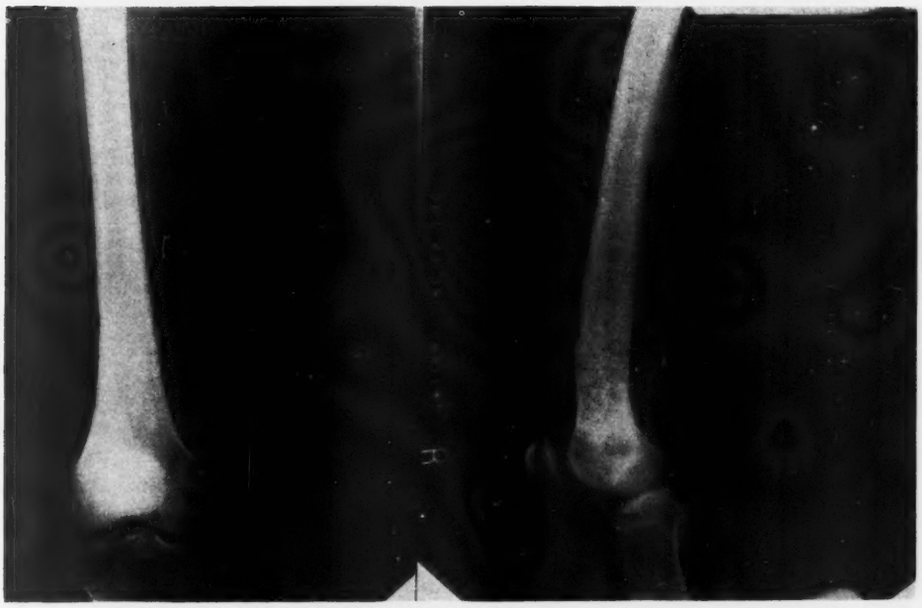


Fig. 3. Right femur, after the third operation (October, 1939): There are four drill holes in the lower end. A small defect on the lateral cortex, approximately 7 mm. long, can be traced back to the two previous examinations and is doubtless to be accounted for by the channeling of the cortex of the bone two years ago that produced the thinning of the lateral cortex in this region. The femur certainly shows no progressive process and comparing the films of two years before, the bone in the lateral half of the femur in the lower fourth has a more nearly normal texture now than then.

soft tissues posteriorly. The thickening is fairly uniform in the superior portion but there is a multiple cystic appearance which culminates in a large cystic area in the lateral condyle. With the exception of a small amount of squaring of the bony margin of the joint nothing unusual is noted.

"Impression: Findings suggest osteomyelitis of Garré."

After further study of the films the roentgenologist stated, "the diagnosis lies between chronic osteomyelitis and malignant bone tumor." Because of persistent pain, the patient was advised that operation was indicated and this was carried out in 1937.

FIG. 4. Right femur (May, 1940): The bone is very nearly normal in appearance. There is nothing to suggest present disease.

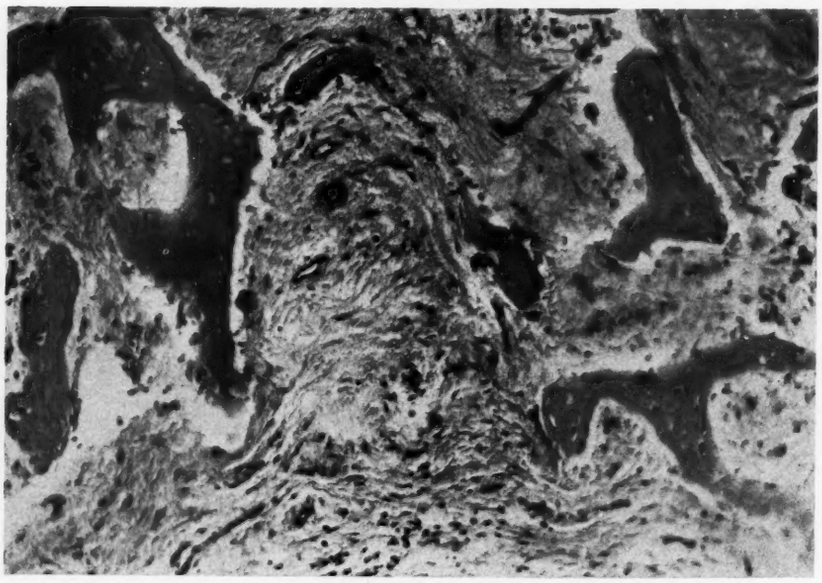


FIG. 5. Photomicrograph showing a complete replacement of the normal marrow by fibrous tissue that is rather sparsely vascularized and shows slight lymphocytic infiltration. The bone trabeculae, in this instance, do not show the widening and encroachment upon the marrow spaces that are seen elsewhere in the section and which is evidenced in the gross examination by extreme eburnation. Diagnosis: chronic osteomyelitis of Garré. × 400.

An incision was made on the outer aspect of the right lower thigh. The soft tissues appeared normal. The periosteum of the femur was

smooth and glistening and easily separated from the underlying cortex which was irregular and rough. Two drill holes were made and a portion of the cortex removed. This was hard, of ivory-like consistency, considerably widened, with the marrow cavity almost obliterated. There was very little bleeding from the bone and no evidence of suppuration. The tissues were closed in layers.

Four weeks later because of persistent pain, the same region was explored and a section of eburnated cortex, one inch wide and four inches long was removed. The cyst (?), as shown by *x*-ray, in the external condyle was curetted and contained granulation tissue only. The tissues were closed in layers with a rubber drain placed down to the muscle. A serous type of drainage persisted for five weeks.

The patient was discharged from the hospital four weeks later and for four months no weight bearing was permitted. Then she gradually increased the use of the leg and seven months from the time of operation returned to normal activity.

Five months later pain in the right lower thigh recurred and for the first time tenderness developed on the inner aspect of the lower right thigh. There was redness, induration, and increased heat with the patient's temperature elevated to 100°F. These attacks lasted two to three days but recurred about every two weeks. Repeated *x*-rays of the femur revealed a gradual improvement in the appearance of the bone. However, these episodes occurred with increasing frequency, persisting longer, and gradually incapacitated the patient. Although the signs were superficial and *x*-rays showed the femur gradually becoming more normal, it was believed that infection of the bone had gradually involved the soft structures of the lower thigh. Consequently, a third operation was resorted to, two years following the previous one.

Third Operation. A long incision was made along the inner lower right thigh. Within the ligamentous expansion of Vastus medialis there was an area 1½ cm. in diameter consisting of granulation tissue surrounded by thickened but otherwise normal appearing ligament. This tissue was excised. The incision was deepened down to the femur without encountering further evidence of inflammation. The periosteum was not thickened and easily separated from the entire circumference of the underlying cortex which was smooth. Four drill holes were made. The cortex appeared normal in density and thickness and there was free bleeding from the drill holes. No pus was encountered. The tissues were closed in layers.

Six *x*-ray treatments were given because of some tenderness persisting medial to the patella about one inch from the previous inflammatory site. The patient was kept inactive for three months.

Fifteen months later the patient had remained relatively well but periodically there was mild pain about the right knee and occasional episodes of tenderness in the tissues in the region of the previous operative site. *X*-rays of the femur have been negative for further evidence of inflammation.

Pathological Report. Bone from first operation; sclerosing osteomyelitis. (Fig. 5.) Culture of granulation tissue, Staphylococcus aureus hemolyticus of low virulence; ligamentous tissue from the third operation; chronic desmositis. (Figs. 6 and 7.) Culture of tissue from third operation; an unidentified diplococci.

The above case illustrates the symptoms characteristic of this interesting disease: first, its chronicity extending over a period of years; secondly, its similarity, in the early stages to rheumatoid arthritis; thirdly, the recurring exacerbations with elevation of temperature, moderate elevation of leucocytes without significant change in percentage of polymorphonuclears, and increased pain in the area involved. The absence of preceding infection or trauma was noteworthy.

DIAGNOSIS

Sclerosing osteomyelitis is to be differentiated from syphilis of the bone and sarcoma. Osteal night pain is common in syphilis and osteomyelitis and the tibia is said to be most frequently involved in both. However, the various stigmata and a positive Wassermann blood test rule out lues.

The real difficulties lay in differentiating osteomyelitis from sarcoma. The clinical findings in each are similar. An initial rise in temperature occurs in both. The duration of symptoms averages ten months

(Geschickter,[6]) in sarcoma, whereas it is usually years in osteomyelitis. An elevation of leucocytes may be present in both. this is not constant. Sarcoma (Ewing's) begins mildly but rapidly produces, within a few months, acute symptoms, whereas in

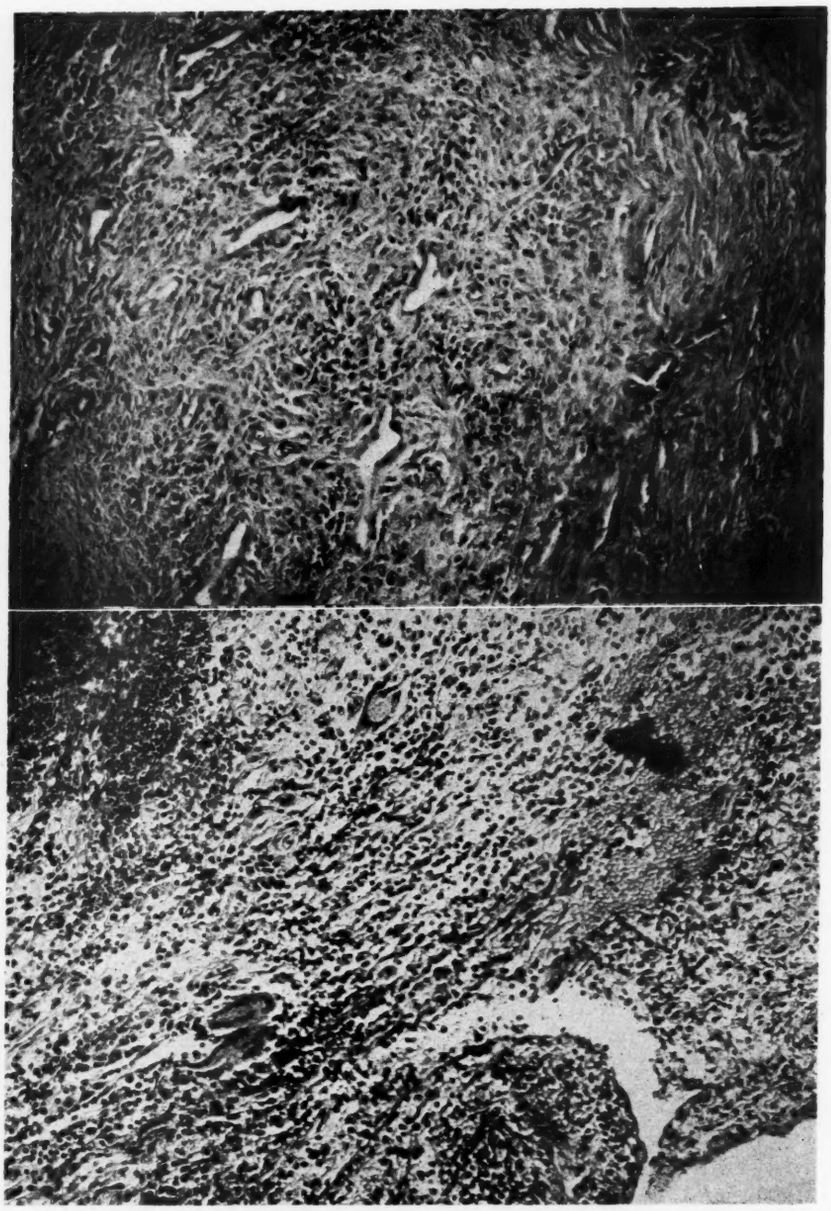


FIG. 6. Above; ligamentous tissue that is rather widely infiltrated by lymphocytes and not too well vascularized. There is no marked degeneration other than a certain amount of hyaline swelling. The striking feature is the large number of lymphocytes scattered through the tissues. Diagnosis: chronic desmositis.

FIG. 7. Below; a loosely organized granulation tissue is shown here in which several foreign body giant cells are well demonstrated. There is one area of extensive hemorrhage. Note that the giant cells are unassociated with epithelioid cells and that there is no caseation. Diagnosis: same as Figure 6.

A loss of weight is common in sarcoma but also may be a finding in osteomyelitis. With the latter disease, there is more commonly infiltration of soft parts, but sclerosing osteomyelitis there is often an acute onset with fever and leucocytosis which rapidly subsides into a chronic course extending over a period of years.

The *x*-ray appearance in the typical case differs somewhat although the area of tumefaction in osteomyelitis resembles the early stages of Ewing's sarcoma. There is formation of new bone in the periosteal and cortical zones. As a result the medullary cavity is narrowed or obliterated while the cortex is widened and its density markedly increased. Ossification is more pronounced than in sarcoma. Furthermore, sarcoma shows a dense formation of bone in some areas and secondary destruction in others producing a difference in structure or mottling effect. This also may be confusing as a similar *x*-ray appearance at times occurs in sclerosing osteomyelitis. This is due to the areas of increased fibrosis within the bone structure which cast a less dense shadow producing the variation in density. It is not always possible to distinguish definitely between the two and the resort to biopsy may be necessary.

TREATMENT

Exposure of the medulla by generous removal of the overlying cortex and consequently the eburnated bone has proved the most satisfactory measure. Bacteriophage, deep *x*-ray therapy, and vaccine have been tried with apparently some but no lasting benefit. The case above responded well to removal of a generous part of the ivory-like cortex and the subsequent long period of rest. This is an important adjunct in the treatment of this unusual disease.

The recurrence of symptoms was at first thought to be the result of a sinus extending upward from the bone. They were due, however, to the subacute ligamentous inflammation which required the third operation for its relief. The deep *x*-ray therapy was no doubt an important factor in relieving the second site of ligamentous inflammation at the inner border of the patella which appeared shortly after this operation.

The patient still has some discomfort in the right lower thigh after undue activity. There is no limitation of motion at the knee joint, but there is some discomfort during the extremes of motion. The length of the right leg is the same as the left. Circumference of the thigh at the upper margin of the patella and that of the calf is 1 cm. less than that of the left at the same levels.

SUMMARY

1. A case of chronic sclerosing osteomyelitis is presented.

2. Its pathology is the result of a persistent irritation of the bone by an infectious agent most commonly a Staphylococcus aureus of low virulence.

3. Its diagnosis is not always easy and is to be differentiated from syphilis of the bone and Ewing's sarcoma.

4. Treatment is not entirely satisfactory but it responds best to surgical intervention.

5. Subacute desmositis is a rare complication and one heretofore not described as a complication of this disease.

6. A long period of inactivity and deep *x*-ray therapy is an important adjunct in treatment.

REFERENCES

1. BENNETT, G. E. and HOPKINS, J. V. Sclerosing osteomyelitis associated with trichinosis. *J. Bone & Joint Surg.*, 10: 834–839, 1928.
2. BLOODGOOD, J. C. Bone disease; non-suppurating osteomyelitis (Garré) etc. *J. Radiol.*, 3: 310–317, 1922.
3. GARRÉ, C. Forms of acute infectious osteomyelitis; part 3, the sclerosing, non-suppurative form of osteomyelitis. *Beitr. z. klin. Chir.*, 10: 241, 1893.
4. GESCHICKTER, C. F. and COPELAND, M. Garré's non-suppurative osteitis. *Am. J. Cancer*, pp. 775–779, 1936.
5. HENDERSON, M. S. Chronic sclerosing osteitis. *J. A. M. A.*, 82: 945–949, 1924.
6. JONES, S. F. Sclerosing non-suppurative osteomyelitis as described by Garré, with a report of a case. *J. A. M. A.*, 77: 986, 1921.
7. KAUFMANN, E. Pathology. English Edition: vol. II, pp. 1102 and 1106. Translation by Reimann. Philadelphia, 1929. P. Blakiston's Son & Co.
8. SWETT, P. P. Form of sclerosing osteomyelitis following fractures of long bones. *New England J. M.*, 214: 7, 1936.
9. TRENDEL. Osteomyelitis. *Beitr. z. klin. Chir.*, 41: 607, 1903–1904.
10. WISHNER, J. G. Chronic sclerosing osteomyelitis: Garré. *J. Bone & Joint Surg.*, 15: 723–732, 1933.

GENERAL CONSIDERATIONS OF FISTULA-IN-ANO*

THE RÔLE OF FOREIGN BODIES AS CAUSATIVE FACTORS

ALFRED M. BUDA, M.D.
Associate Proctologist, Brooklyn Hospital
BROOKLYN, NEW YORK

FISTULA-IN-ANO has been one of the earliest known afflictions of mankind as evidenced by mention of its existence in early Biblical literature.[1] However, the first surgical treatise on anal fistula is accredited to John Arderne, an English surgeon of the fourteenth century.[2]

Much has been written about anal fistula since Arderne's time, but the surgical principles remain the same, namely, finding the internal opening and then completely excising the tract.

Simple fistula-in-ano is found more commonly in males than in females. No satisfactory explanation for this has been advanced. The distribution among the sexes shows about 70 per cent occurring in males.[3,4] Buie[5] found the incidence in males to be about 60 per cent.

Anal fistula comprises less than 1 per cent of the total number of admissions in general hospitals. This is shown in Table 1.

TABLE 1
INCIDENCE OF SIMPLE FISTULA-IN-ANO IN GENERAL HOSPITALS

Observers	Hospitals	Year	No. Admissions	Fistula or Abscess	
				Number	Per Cent
Leslie[6]	Vancouver Gen.	1924	4648	24	0.52
Leslie[8]	Mass. General	1924	4351	30	0.69
Author	Brooklyn Hosp.	1930–39	77372	532	0.69

Anal fistula and perianal abscess are always intimately associated, the abscess being a concomitant or precursor of the fistula.

Injury to the anal crypts with subsequent infection is considered to be the main factor in the production of fistula. These crypts, situated at the pectinate line, dividing the rectum proper from the anal canal, open as pockets facing the rectum above. They are constantly exposed to repeated trauma and infection from the fecal stream above, and often serve as receptacles for foreign bodies coming down from the upper intestinal tract.

In regard to tuberculosis as a cause of fistula-in-ano, it is now believed that the tubercle bacillus is only a secondary invader of the anorectum, the primary source of infection being usually in the lung.

Not so long ago, anal fistula was considered to be always of tuberculous origin. Richard C. Cabot,[7] in his book on "Differential Diagnosis," stated that fistula in ano was a tuberculous affection in practically every case. This belief has been disproved by clinical and scientific investigation. "In no instance," says Buie,[8] "has evidence of tuberculosis been found within tissue removed from a fistulous tract unless patients harbored either active or quiescent foci of tuberculosis in other parts of the body."

It is the opinion of diligent observers that in general hospitals the incidence of tuberculosis in anal fistula is about 2 per cent. In Buie's[5] series of 1,000 cases of fistula 2.2 per cent were considered to be of tuberculous origin on histopathologic examination. Bacon,[9] in a series of 400 cases found the incidence of tuberculosis in anal fistula to be 1.7 per cent.

In active cases of pulmonary tuberculosis, the incidence of tuberculous anal fistula is much higher. Table 11 shows the

* From the Surgical Service, Division of Proctology, The Brooklyn Hospital, Dr. Ernest K. Tanner, Chief Attending Surgeon.

incidence of fistula as a complication of pulmonary tuberculosis.

Table II
ANORECTAL FISTULA AS A COMPLICATION OF PULMONARY TUBERCULOSIS

Observer	Year of Report	No. of Cases	Hospital	Per Cent
Clarke[10]	1924	185	City of London, Hospital of Heart and Lungs	6.0
Petter and Fansler[11]	1931	1500	Glen Lake Sanatorium	6.0
C. L. Martin[12]	1933	10000	Chicago Municipal	7.0
Marino, Buda and Skir[4]	1938	357	Kingston Avenue	11.7

In a discussion of anal fistula, mention must be made of the anal ducts and anal glands. The existence of these structures has been a subject of controversy among anatomists, although Tucker and Hellwig[13] seem to have demonstrated convincingly their existence and histologic appearance. They are considered vestigial organs and are found also in some of the lower animals.

These tubular branching structures pass into the muscular coat of the anal canal and are lost in the connective tissue. Some are said to pass through the internal sphincter fibers and to terminate in the ischiorectal fossa.

Tucker and Hellwig conclude that cryptitis, anal fistula and perirectal abscess originate in these preformed anal ducts, and that these ducts explain the frequency of anal infections.

Pope and Gunn[14] have done similar work along these lines and have been able to confirm all the findings of Tucker and Hellwig. They were also able to demonstrate a definite inflammatory reaction of the crypt wall itself.

As Hayden[15] remarks, "These researches, coupled with the fact that the internal opening of an anal fistula, in the majority of cases, is found in the depths of a crypt, would seem to provide convincing evidence that most if not all perirectal abscesses from which fistulae develop, are a direct result of inflammation in the crypts and their subsidiary ducts."

And, as Buie[8] states, "There never has been an anal fistula without a primary internal opening, and that opening is always in the anal crypts. All abscesses of anal origin come from a source within the anal crypts."

Man has always dreaded fistula and has feared the operation for its cure. This is not without good reason; for, in some instances, not only is the patient not cured of his disease, but a greater affliction confronts him in the form of anal incontinence due to poor surgical management. As Lockhart-Mummery[16] has said, "A fistula operation is not a major operation, but it is far from being a minor one."

Successful operation for anal fistula involves certain well established principles. One of the first objectives to be obtained in its cure is to provide adequate drainage, and this drainage must continue throughout the process of healing. All subsidiary tracts must be sought and exposed and freely excised. The fistulous tracts should be excised in such a way as to convert the areas into wedge-shaped fossae, the skin wound being larger and wider than the deeper wound. This allows the base of the wound to heal sooner than the surface wound, thus affording continuous drainage of the deeper structures until complete healing results.

At times it becomes necessary to incise the sphincter muscle when a fistulous tract lies beneath it. It is advisable in such cases to cut the muscle transversely and in one place only, as otherwise incontinence may supervene.

When one is dealing with an extensive fistula, the operation may have to be done in several stages so as to avoid serious damage to the anal musculature. When two separate internal openings exist and the tracts lie beneath the sphincter muscles, the operation for each fistula should be done at different times. The second operation should be performed only after complete healing takes place following the first operation.

It is not advisable to pack the resulting wounds tightly or for more than twenty-four hours where the sphincter muscle has been incised; for this tends to keep the severed muscle ends apart, preventing their union and thus predisposing to anal incontinence. Bridging of tissue during healing should be prevented.

In tuberculous anal fistulae, in cases in which the patient's sputum is negative, the wounds heal about as quickly as in non-tuberculous subjects. In patients with positive sputa, the prognosis as to complete healing is usually good, although convalescence is often protracted.[4]

Surgical judgment at the time of operation, finding of the primary opening, judicious and adequate postoperative care are all important factors in the successful outcome of fistula operations.

Low spinal anesthesia is well suited for operations for anal fistula as this gives complete relaxation to the parts involved with least inconvenience to the patient.

We have found the prone, inverted V (Depage) position superior to the lithotomy position in operations about the anorectum.

FOREIGN BODIES

Instances of foreign bodies in anal fistulae occur perhaps oftener than recorded, either because the surgeon fails to look for them at the time of operation, or, as often happens, the foreign body is extruded at the time the abscess ruptures spontaneously, or at some other time before operation.

In the ten year period from 1930 to 1939 there were 532 patients operated upon at the Brooklyn Hospital for fistula-in-ano or abscess with fistula. In only five cases (0.9 per cent) was a demonstrable foreign body recorded as having been found at operation. As stated above, it is the author's opinion that this is only a small percentage of cases in which a foreign body was actually responsible for the fistula. No doubt, in many of these cases of fistula, a foreign body must have been extruded before the operation.

The foreign bodies found in anal fistulae vary. Fish bones are the usual objects found, although seeds, toothpicks, pieces of metal or wood are also found at operation. A sewing needle was found in one of our cases reported here.

Some men have the habit of chewing on a toothpick while conversing. The toothpick is often unwittingly broken and parts of it swallowed. Months later, the individual may present himself to his physician with a perianal abscess and subsequent fistula. He is amazed when the surgeon informs him of his findings at operation. This happened in one of our cases.

Perardi[17] reports a similar interesting case. A patient with a large ischiorectal abscess came to him for treatment. On incising the abscess and evacuating the pus, there was found at the base of the abscess cavity a small piece of wood one inch long with a pointed end. On being questioned, the patient stated that he was a tobacco chewer, but when out of tobacco, he had the habit of chewing on pieces of wood, and occasionally he would unintentionally swallow small bits of it. No doubt he terminated this pernicious habit after this unexpected result.

CASE REPORT

Of the five cases in our series in which the patients were operated on for fistula and in which foreign bodies were found, a toothpick was recovered in one, a calcareous object in another, fish bones in two, and in another patient, a sewing needle.

I shall report this last case in detail because of its interest.

R. C. was a single woman, twenty-one years of age, who for the three months prior to admission to the hospital had pain in the left buttock with a discharge of pus in this area. Examination disclosed the following: On the medial aspect of the left buttock, in the left posterolateral perianal area, 15 cm. from the anal verge, was the external opening of a fistula. The internal opening was located posteriorly at the anorectal line in a crypt. A deeply situated, indurated, cord-like structure

extended from the external opening to the internal opening of the fistula. At about the center of this fistulous tract, 2.5 cm. from the anus, there was felt a fluctuating mass, about 2 cm. in diameter, evidently an abscess.

The fistula was probed, and with the probe in position, an attempt was made to dissect out the whole fistulous tract threaded on the probe. However, when the abscess was reached, the dissecting scissors cut through it, so that the abscess walls had to be dissected out separately. In the bed of this abscess there was found a rusted sewing needle 5 cm. long. The "eye" part of the needle was missing. The whole fistulous tract, abscess walls and all necrotic tissue were completely excised. Complete healing occurred in twelve weeks. *X*-ray examination of the region failed to show any trace of the missing "eye" part of the needle.

The question here arises as to how the needle got into this location. It is highly improbable that the patient had swallowed it. Interrogation of the patient failed to elicit any adequate explanation. She did not remember having ever felt any sticking sensation in this area.

CONCLUSIONS

1. Simple fistula-in-ano occurs comparatively infrequently in general hospitals, being met with in less than 1 per cent of all admissions.

2. In hospitals devoted solely to tuberculosis, the incidence of fistula is much higher varying from 6 per cent to over 11 per cent of hospital admissions.

3. Tuberculous anal fistula is found only in individuals who harbor a primary source of tuberculosis elsewhere in the body, usually the lungs, and is encountered in general hospitals in about 2 per cent of all anal fistulae. However, in tuberculous subjects, the majority of fistulae and perianal abscesses are in themselves tuberculous in character as a result of secondary infection with the Koch bacillus.

4. Demonstrable foreign bodies found at operation for anal fistula are few in number, being recorded in only 0.9 per cent of our series of over 500 cases of fistula operations.

5. Although the operation for anal fistula is not a "formidable" one, yet, the surgeon undertaking the operation should be well informed about the anatomical considerations and well versed in the surgical principles involved.

REFERENCES

1. Lloyd-Davis, O. V. Fistula in ano. *Practitioner*, 136: 186, 1936.
2. Arderne, J. Treatise on Fistula in Ano. Edited by D'Arcy Power, 1910.
3. Morgan, C. I. N. An analysis of 100 cases of perianorectal infection. St. Marks Hospital. *Proc. Roy. Soc. Med.*, 22: 1351–1358, 1929.
4. Marino, A. W. M., Buda, A. M. and Skir, I. Anorectal tuberculosis. *Tr. Am. Proct. Soc.*, 1938.
5. Buie, L. A. Anal fistulectomy. *J. A. M. A.*, 97: 1208–1211, 1931.
6. Leslie, G. L. Importance of the tubercle bacillus in the etiology of ischiorectal abscess and fistula in ano. *Canad. M. A. J.*, 16: 1215–1220, 1926.
7. Cabot, R. C. Differential Diagnosis. Philadelphia, 1912. W. B. Saunders.
8. Buie, L. A. Practical Proctology. Philadelphia, 1937. W. B. Saunders.
9. Bacon, H. E. Perianal tuberculosis. *Proct. Soc. Grad. Hosp. Univ. Penn.*, Oct. 1933.
10. Clarke, B. R. Note on the relationship of ischiorectal abscess and fistula in ano to pulmonary tuberculosis. *Tubercle*, 7: 277–280, 1926.
11. Petter, C. K. and Fansler, W. A. Tuberculosis of the anus and rectum. *Nat'l. Tuberc. Assoc.*, pp. 159–163, 1930.
12. Martin, C. L. Tuberculous fistula in ano. *J. A. M. A.*, 101: 201–205, 1933.
13. Tucker, C. C. and Hellwig, C. A. Histopathology of the anal crypts. *Tr. Am. Proct. Soc.*, 1933.
14. Pope, C. E. Discussion.[13]
15. Hayden, E. P. The Rectum and Colon. Philadelphia, 1939. Lea & Febiger.
16. Lockhart-Mummery, J. P. Fistula in ano. *Lancet*, 1: 657, 1936.
17. Perardi, G. *Policlinico*, 41: 1668, 1934.

THE RIGHT LATERAL RECTUS INCISION IN ACUTE APPENDICITIS

C. GRANT BAIN, M.D.
On Staffs of St. Helen's Hospital, Chehalis, and General Hospital, Centralia
CHEHALIS, WASHINGTON

IN recent years the McBurney incision has been advocated for use in all appendectomies in chronic as well as acute and complicated cases.[1] Some would even say that the mortality in appendicitis has been markedly reduced by its use, but the mortality is in the complicated cases and the writer seriously questions the advisability of the general use of the McBurney incision in them. The right lateral rectus incision has been known by many names such as Battle, Jalaguier, Kammerer and Lennander.[2]

The position of the base of the appendix is usually below McBurney's point which is about halfway along a line from the anterior superior iliac spine to the umbilicus. The base of the appendix is usually at the level of the anterior superior spine at the linea semilunaris. Most appendix surgery is done in this region and consequently the nearer the middle of the incision is to this location the better.

The right lateral rectus incision fulfills this desideratum more completely than any other. It is a slightly oblique incision just lateral to the lower right rectus muscle or just over the lateral edge of the muscle through the rectus sheath; then using some slight displacement of this muscle edge mesially, the posterior sheath is exposed. This is not a muscle splitting incision. The muscle is disturbed only by temporarily retracting the lateral edge mesially, and in closing it resumes its original position between the two layers of fascia. The other great advantage apart from its location is that this incision can easily be extended upward or downward as occasion frequently demands. This is of inestimable advantage in complicated cases. It is also of advantage should the diagnosis be inaccurate and should other organs have to be investigated. It also has the advantage of giving the best exposure to the blood supply of the appendix. Moreover, the site of this incision is more readily accessible to the omentum especially if this structure is short. The right paracolic gutter is not disturbed. Less tissue planes are opened up than with any other incision. A firmer abdominal wall results because the intact rectus muscle is interposed between the fascia layers. There is no injury to nerves or blood vessels. The site is well adapted to the use of local anesthesia as the rectus sheath offers a suitable enclosure for depositing the anesthetic solution. The nerves are small and relatively terminal. The elimination of forceful retraction also recommends this incision both for local and spinal anesthesia especially the elimination of forceful traction on the cecum. The incision is over the usual location of complications. Drainage tubes pass more directly to the stump of the appendix and to the pelvis especially when the full, right lateral (three-quarter prone) position is maintained postoperatively.

Contrary to previous teaching the appendix does not usually point up and in toward the spleen. The postcecal and retrocolic positions are by far the commonest, amounting to over 65 per cent. The next most common locations amounting to some 30 per cent are those which hang over the brim of the pelvis.[3] Consequently, complications are met with behind and below the cecum and to the inner side, at least those short of fully developed abscess. When peritonitis is present, the location of the cecum and appendix is most difficult to determine but the patient can usually

point to the location of the appendix except perhaps in cases which have been allowed to wait too long. Secondary abscesses are usually first located in the pelvis because the initial spread is in that direction. In many complicated cases the appendix and cecum are bound down and friable. This will not permit much in the way of traction should a laterally placed incision have been used. The usual location of the appendix is "down and in."[4,5] The incision, therefore, giving best exposure in these directions is preferable.

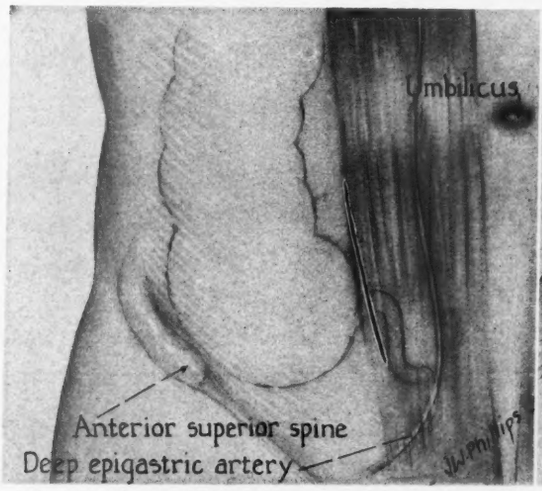


Fig. 1. The incision is made over the lateral border of the rectus muscle, with the midpoint on a line between the umbilicus and the anterior superior spine.

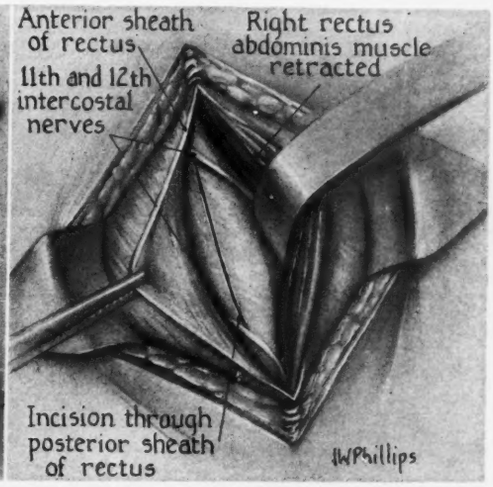

Anterior sheath of rectus
Right rectus abdominis muscle retracted
11th and 12th intercostal nerves
Incision through posterior sheath of rectus
IWPhillips

Fig. 2. Showing the muscle retracted medially and the incision through the posterior sheath of the rectus muscle between the eleventh and twelfth intercostal nerves.

As to the question of facility for conducting the operation, the incision described probably necessitates less in the way of assistance than the so-called muscle splitting or cutting incisions because little in the way of retraction is necessary. Better direct visualization, especially of the mesoappendix, can be had with this incision and the pelvis can be more easily reached.

Injury to a terminal intercostal nerve only rarely occurs because the operation can usually be accomplished between two of the intercostal nerves (eleventh and twelfth) going to the lower rectus. Occasionally, one nerve has to be cut but the writer has never seen any demonstrable rectus muscle paresis following. This is of definite advantage because there is some evidence that the lateral incisions have been followed by right inguinal and incisional hernias[6,8] (including bulgings). In infected cases with drainage this occurrence seems to be as common in one as the other, especially when one realizes that the right rectus incision has been used in the older age groups.[7,8,9] Apparently statistics compare only the right rectus muscle "splitting" incision.

With regard to drainage with the right lateral rectus incision, the postoperative posture of the patient is most important. Some claim that a full prone position is necessary to lower mortality,[10] and others believe a laterally placed drain is necessary. The fully prone position is very uncomfortable and laterally placed drains are not very efficient in draining over the brim of the pelvis. It has been proved that drainage of the pelvis and of the iliac fossa can be accomplished by a full right lateral position or an incomplete prone posture.[11] This has been used for twenty-four to forty-eight hours after operation with a soft noncollapsible rubber tube as drain. This right lateral rectus incision has been used in fifty consecutive cases of ruptured appendix with drainage, with a mortality of 4 per cent.[12] One of the two

patients lost was eighty-four years old. Only one incisional hernia has appeared over a period of almost seven years and that in an obese woman of sixty-four who had much secondary wound infection. In five cases the whole chromic fascia suture line was removed postoperatively because of infection with no apparent adverse effect on the scar. There were no cases with mechanical obstruction and none with secondary abscess.

The right lateral rectus incision is recommended for cases in which there is an acute condition of the appendix especially in which some complication is suspected.

SUMMARY

In recent years the McBurney incision for appendectomy has been recommended highly. Its advantages are unquestioned but its disadvantages suggest themselves when the advantages of the right lateral rectus incision are considered especially in acute cases which may have developed complications. Moreover in those acute cases in which the diagnosis is not completely clear and in those so-called chronic cases in which some exploration may be desirable at operation, these advantages become even more apparent. The right lateral rectus incision is more directly over the site of the appendix, the meso-appendix and localized complications. The incision avoids damage to anatomical structures; it lends itself to extension readily in either direction; it permits a firm closure even when drainage has to be employed and it facilitates the operative procedure.

REFERENCES

1. Horsley and Bigger. Operative Surgery. 4th ed., p. 778. St. Louis, 1937. C. V. Mosby Co.
2. Deaver, John B. Appendicitis, Its Diagnosis and Treatment. 4th ed., Philadelphia, p. 37. 1913. P. Blakiston's Son & Co.
3. Wakeley, Cecil P. G. The position of the vermiform appendix. *M. Press.*, 134: 141–144, 1932.
4. Monks, Geo. H. and Blake, J. B. The normal appendix. *Boston M. & S. J.*, 147: 581–583, 1902.
5. Purser, Cecil and Rennie, Geo. E. The position of the vermiform appendix. *Tr. Inter. Med. Cong. Australasia*, pp. 696–697, 1892.
6. Balfour, D. C. The occurrence of right inguinal hernia following appendectomy. *Railway Surg. J.*, 19: 117–119, 1912.
7. Fowler, Frank E. Hernia following the use of this McBurney incision. *Ann. Surg.*, 81: 525–527, 1925.
8. Heineck, Clive P. Postoperative incisional and recurrent hernias of the anterior and lateral abdominal wall. *West. J. Surg.*, 43: 33–35, 1935.
9. Carlucci, Gaston A. Abdominal wall defects following appendectomy. *Ann. Surg.*, 100: 1177–1183, 1934.
10. Williamson, E. G. and Rankin, L. M. Postoperative postural drainage. *Am. J. Surg.*, 45: 528–553, 1939.
11. Kennedy, J. W. Practical Surgery of the Abdominal and Pelvic Regions. 2d ed., p. 198. Philadelphia, 1934. F. A. Davis Co.
12. Bain, C. G. Fifty ruptured appendix cases with two deaths. (In press.)

EXTRAUTERINE FIBROMYOMAS

G. D. Scott, M.D. and Irvin H. Scott, M.D.
SULLIVAN, INDIANA

FIBROMYOMAS, pure myomas and pure fibromas not directly connected with the uterine musculature, are exceedingly rare, there being only about 250 cases reported in the literature to date. In order of most common occurrence they may be located in the vagina, either in the posterior or anterior wall, in the broad ligament of the uterus or in the round ligament of the uterus. (A fibromyoma in the vagina and two in the broad ligament, one of which had undergone sarcomatous degeneration, will be presented.)

There have been several theories advanced concerning the etiology of this type of tumor, all of which have some logical and some illogical points of reasoning. It is necessary for fibromyomas to be derived from some anatomical structure which is made up of both connective tissue and smooth muscle. This anatomical structure is one which usually is very vascular. The statement has been made that fibromyomas of the uterus actually arise from the walls of blood vessels and arrange their fibers of smooth muscle and connective tissue in whorls to simulate the histological structure of a blood vessel itself. Hence, they are extremely common in the uterus which has a rich blood supply.

Some authors state that fibromyomas of the vagina are derived from remnants of the Müllerian and Wolffian ducts. This is quite possible, although since these embryological structures consist of both mesoderm and ectoderm, tumors arising from them should contain some glandular tissue which is not usually the case. This theory would not account for tumors which were in no way connected with these two above named structures.

Grossly, these tumors vary in size from a microscopic structure to quite large tumors. They are usually hard to palpation and yellowish to pearly white in color, just as fibromyomas of the uterus. The consistency depends upon the relative amount of fibrous tissue and smooth muscle composing the tumor. They are usually discrete and well encapsulated. Histologically, they consist of fibrils of connective tissue and smooth muscle closely interwoven with one another and tend to form whorls of tissue. The cells are usually of similar size and shape and present no mitotic figures, making them primarily a benign tumor.

The fate of these tumors, like those of the uterus proper, is varied. Most commonly they remain as benign structures which may attain a large size. They may undergo necrosis due to impaired blood supply and this necrosis almost always begins in the center portion of the tumor. Some undergo hyalinization and even calcification. From an *x*-ray examination, one such tumor in the anterior vaginal wall was mistaken for a large calculus in the urinary bladder and the bladder was opened for the removal of the calculus. Like those fibromyomas of the uterus proper they may undergo sarcomatous degeneration in which case they become extremely malignant and metastasize rapidly.

The symptomatology of extrauterine fibromyomas varies greatly with the location and size of the tumor. For the most part they produce pressure symptoms. Probably the most consistent symptom of anterior vaginal wall fibromyomas is that of partial and in some cases complete obstruction of the urethra. In the vagina they commonly become ulcerated and produce a bloody, purulent discharge and quite frequently may be mistaken for menorrhagia or metrorrhagia. Some patients will first complain of dyspareunia. Those rising from the various ligaments of the uterus and attaining a large size present a difficult

diagnostic task and due to their rarity are usually thought to be ovarian tumors.

CASE REPORT OF VAGINAL FIBROMYOMA

CASE I. Mrs. F. S., age forty-seven years, was referred to us with a diagnosis of a cystocele. She complained of soreness and pain in the vagina, particularly when in a sitting position. She stated that for the past four years she had noticed a mass protruding from the vagina. The mass had made a gradual increase in size during the four year period until on the date of admission it was about the size of a large orange. Her menstrual periods, four months prior to admission, had always been normal but since that time her periods had increased in duration up to two weeks although the daily flow was no more profuse. For the past two months she had had a leukorrhea and dyspareunia. She had noticed burning on urination and during the last week had noticed a partial obstruction to the flow of urine. Obstetrical history revealed that there had been no pregnancies. Past illness and family history were of no significance.

Physical examination revealed a well developed, well nourished, white female, appearing to be about forty-five to fifty years of age. The head, neck and chest were essentially negative. The abdomen was essentially negative except for moderate tenderness over the region of the urinary bladder. On vaginal examination inspection revealed a mass bulging from the introitus which was covered with a leathery appearing vaginal mucosa. This mass was pear-shaped, with the apex near the urethra. It had the general appearance of a cystocele. To palpation the mass was moderately firm and slightly moveable. The mucosa covering the mass was rather leathery to palpation. Due to tenderness on manipulation of the cervix, the body of the uterus was not palpable. Later, under ether anesthesia, the cervix and body of the uterus were apparently normal to palpation. On rectal examination the mass was palpable. Since a bladder tumor was considered, a cystoscopic examination was made which revealed the bladder mucosa to be normal. The urinalysis was essentially negative, showing only a one plus albumin. The blood count revealed a 70 per cent hemoglobin, a red blood count of 4,100,000, a white blood count of 6,750 with 76 per cent polymorphonuclear leukocytes. A diagnosis of a cystocele or a tumor of the vaginal wall was made.

Under ether anesthesia an incision was made through the mucosa of the anterior vaginal wall directly over the mass. On dissecting back the mucosa a firm, perfectly round tumor mass about the size of a large lemon bulged into the operative field. It was well encapsulated and easily enucleated except for a small pedicle which was adherent to the fascia surrounding the urethra. This pedicle was ligated and severed and the tumor removed.

The pathological report stated that the tumor measured 6 cm. in diameter. It was firm and the cut surface was pearly white in color. Histological examination revealed many connective tissues and smooth muscle fibers arranged in parallels and in whorls. The comparative amount of smooth muscle and connective tissue was about the same. All cells were approximately the same shape and size and no mitotic figures were seen. The pathological diagnosis was fibromyoma. The patient made a satisfactory recovery and has had no similar complaints since the removal of the tumor.

CASE REPORTS OF FIBROMYOMA OF THE BROAD LIGAMENT

CASE II. Mrs. D. B., age sixty-six years, was admitted complaining of abdominal pain. She stated that her first symptoms began six months prior to admission at which time she began to have nocturia and a feeling of pressure in the abdomen, being more pronounced in the lower left quadrant. About two weeks following the onset of her symptoms she noticed a small mass just above the symphysis pubis just slightly to the right side of the midline. For the past three months the mass had made a rapid increase in size until at the time of the first examination the tumor mass almost filled the entire abdominal cavity. Although she was not certain, she believed that she had lost a few pounds in weight within the last month. Her history revealed that she had begun her menstrual periods at twelve years of age and passed a normal climateric at fifty-one years of age. She had had five children, all being normal deliveries. Her family history revealed that her mother died at the age of seventy-six years from a carcinoma of the body of the uterus.

Physical examination revealed the blood pressure to be 210/110, pulse irregular, heart rate 102, temperature 99.2°F. The head and neck were essentially negative for any pathological condition. There was no cervical ade-

nopathy. The heart was markedly irregular and the heart tones were accentuated both on the right and on the left sides. The abdomen presented a large, hard, nodular mass which arose from the pelvis and extended to a point 3 cm. below the left as well as the right costal margin. The mass was apparently fixed to the posterior parietal peritoneum. Vaginal examination revealed a large, hard and nodular mass which completely filled the pelvis. A diagnosis of a fibromyoma of the uterus or a retroperitoneal malignancy was made.

Under ether anesthesia a midline incision was made from the symphysis pubis to the umbilicus and an exploration of the abdomen revealed a large, hard, nodular, tumor mass which completely filled the abdominal cavity and extended deep into the pelvis. Throughout the tumor mass were many cystic areas which varied greatly in size. The deeper pelvic portion of the tumor was firmly adherent to the surrounding tissues, namely, the sigmoid colon, both the right and left ovaries and the body of the uterus. When the adhesions were freed the mass was found to arise from the base of the right broad ligament. The tumor mass was enucleated with difficulty and removed, and due to the rupturing of several of the smaller cystic areas above described closure was made with drainage. The patient made an uneventful recovery during her two weeks in the hospital.

The pathologist stated that the tumor consisted chiefly of connective tissue and smooth muscle fibrils arranged in whorls. The smooth muscle fibers were myxomatous in character. Throughout the sections were large polychromatic and hyperchromatic type of fixed cells with many mitotic figures. A diagnosis of a fibrosarcoma arising from a benign fibromyoma was made.

Six months following dismissal from the hospital she returned complaining of a cough and a marked loss of weight. Her cough was productive and the sputum frequently contained bright red blood. She died one month later from pulmonary metastasis as shown by *x*-ray examination.

Case III. Mrs. J. H., age forty-nine years, was admitted and gave a history of having had a menorrhagia for the past two years. On various occasions her menstrual periods had lasted for two or three weeks, during which time she always passed a large quantity of clotted blood. She stated that her last menstrual period, which had lasted for three weeks, had occurred about five or six months prior to her admission to the hospital. Since that time she had had no hemorrhages until two weeks before admission she had a sudden hemorrhage which lasted two days. The bleeding consisted chiefly of clotted blood. Since the last hemorrhage she had had a great deal of lower abdominal pain and had felt extremely weak. She also complained of low back pain. Her past history and family history were essentially negative. Her obstetrical history revealed that she had delivered five normal, full term children, following which time she had had a miscarriage during the first trimester of her last pregnancy.

Physical examination revealed a rather obese, white female who gave the general appearance of being very anemic. Her head and neck were essentially normal except for oral palor. Her heart presented no apparent enlargement and no audible murmur. Her breath sounds were clear and there was no dullness to percussion. There was rather marked tenderness in both lower abdominal quadrants. Due to the extreme obesity of the abdominal wall no masses were palpable. Vaginal examination revealed a cervix which was rather large and hard. There was a mass in the pelvis which was wedged into the cul-de-sac of Douglas and seemed to extend to the right side. The red blood count was 3,250,000 with a 68 per cent hemoglobin. The white blood count was 10,500 with 69 per cent polymorphonuclear leukocytes. A diagnosis of fibromyoma of the body of the uterus was made.

Following a blood transfusion of 500 cc. of blood and under ether anesthesia a midline incision was made in the lower abdomen. Exploration of the pelvis proved the body of the uterus to be extremely firm, pearly white, regular in outline and slightly enlarged. Both ovaries were somewhat atrophic. At the base of the right broad ligament there was a hard, regularly outlined, egg-shaped mass which was in no way connected with the body of the uterus.

Following the removal of the right Fallopian tube and ovary, the two peritoneal layers of the broad ligament were separated. The right ureter and uterine artery were found to be firmly adherent to the mass described in the broad ligament. After dissecting the ureter and uterine artery free the mass was removed. It was thought that removal of all ovarian tissue

would eventually cause a cessation of the bleeding from the fibrous uterus so the left Fallopian tube and ovary were also removed. Closure was made without drainage. A postoperative diagnosis of fibrosis uteri and fibromyoma of the right broad ligament was made.

The pathological report stated that the fibrous mass removed from the right broad ligament was a fibromyoma which measured 5 cm. in diameter. The patient made an uneventful recovery and at the present time is well.

SUMMARY

1. Extrauterine fibromas, myomas and fibromyomas are extremely rare.

2. The etiological theories and literature have been reviewed.

3. Three case reports of extrauterine fibromas have been presented, one in the broad ligament which had undergone sarcomatous degeneration, one in the broad ligament which was benign and one in the anterior vaginal wall connected to the distal portion of the urethra and large enough to cause marked urinary symptoms.

REFERENCES

Tuberovsky, D. D. Benign muscular and connective tissue tumors of the vagina. *Akusb. i. zbensk. boliez.*, 40: 655, 1929.

Pistuddi, A. A voluminous fibromyoma of the vagina. *Clin. ostet.*, 32: 396–404 (July) 1930.

Kohler, H. Myoma of the vaginal wall. *Zentralbl. f. Gynäk.*, 52: 1266–1267, 1928.

Schilling, Wilhelm. Myomas of the vagina. *Monatscbr. f. Geburtsb., u. Gynäk.*, 89: 333–440, 1931.

Abraham, Ernst G. A case of myoma of the vagina. *Monatscbr. f. Geburtsb. u. Gynäk.*, 85: 260–262, 1930.

Ingraham, C. B. A case of fibromyoma of the vagina. *Am. J. Obst. & Gynec.*, 14: 25, 1927.

The essential in treatment of . . . rectal and anal abnormalities is to establish a continuity of epithelium between the rectum and skin and thus prevent scar formation and constriction. To provide adequate anal control, the external sphincter muscle must always be utilized.
From—"Abdominal Surgery of Infancy and Childhood"—by Ladd and Gross (W. B. Saunders Company).

ADENOMYOMA OF THE STOMACH*

HETEROTOPIA OF BRUNNER'S GLANDS PRODUCING PYLORIC OBSTRUCTION CASE REPORT

LYMAN W. CROSSMAN, M.D.
Attending Surgeon, City Hospital

AND

JAMES H. KIDDER, M.D.
Associate Surgeon, City Hospital

NEW YORK, NEW YORK

THE presence of aberrant gland tissue in the stomach wall, particularly of pancreatic type, has frequently been reported. However, cases in which gland tissue of the Brunner type is found within the stomach wall, are less frequent and usually occur as small sections of foreign gland tissue which are usually discovered at autopsy or in pathological section, appearing as small adenomas insufficient in size to produce symptoms. The production of a tumor mass sufficiently large to cause pyloric obstruction, is apparently extremely rare. In fact, we have been able to find only one case reported in the American literature.

There is considerable question, too, whether any of these had advanced to the stage of pyloric obstruction capable of producing gastric retention which was actually demonstrated by *x*-ray prior to detection at operation or postmortem examination. The case reported by Woolsey and Millzner[11] (1928) and later noted by Stout[9] (1932) as a single example of lesion which had progressed to muscle hypertrophy and pyloric blocking, was apparently not so determined until after operation on March 5, 1926, when pylorectomy was accomplished. "Dyspeptic" symptoms had continued intermittently since January 1921, and a posterior gastrojejunostomy without resection had been completed in October, 1922, which had given relief for about one year. Subsequently in spite of excellent function of the gastroenterostomy which was revealed by *x*-ray, the symptoms increased and exploratory laparotomy, accomplished in March, 1926, finally revealed the prime etiological factor as an adenomyoma about 4 cm. prepyloric on the anterior wall of the stomach containing mucosal tissue of the Brunner type.

Several other authors have reported cases of adenomyomas of the pyloric end of the stomach. Magnus Alsleben[5] (1903) reported five cases detected at autopsy all of which revealed small glands connected at some point with Brunner's glands of the submucosa. Gruzdeff's[3] (1909) case is said to be the first adenomyoma to be observed clinically and at operation revealed a mass imbedded in the posterior wall of the stomach near the pylorus which on section proved to be alveoli, lined with stomach type of mucosa but apparently closed cavities without connection with the stomach epithelium.

Others, among them Stewart-Taylor[8] (1925), Ramirez-Corria[7] (1926) Hilarowitz[4] (1927) and Wholwill[10] (1929) have all described cases seen either at autopsy or at exploratory operation which revealed small adenomyomas in the pyloric region with alveoli frequently of the pancreatic type and less frequently either of the Brunner type or of an undifferentiated character. In all an increase in smooth muscle strands was noted.

Petrowitch and Davidowitch[6] (1933) reported a case from Belgrade of adenomyoma with abscess in a twenty-one year old white male admitted to the hospital with history of diarrhea for two days; temperature 102°F., pulse 120 with tender abdomen, especially on the right side. He was explored through a McBurney incision

* From The New York City Hospital, Department of Hospitals, Welfare Island, New York City.

and a normal appendix found. The incision was enlarged upward and stomach displayed with difficulty. A dilated pyloric antrum covered with fibrin and very hyperemic appeared. Suspecting a localized phlegmon, a Billroth II resection with drainage was completed. Specimen revealed an abscess the size of a "nut" containing 5 cc. of pus which cultured staphylococci. Sections showed enlarged fibromuscular structures hyalinized about the abscess with adjacent adenomyomatous tumor tissue.

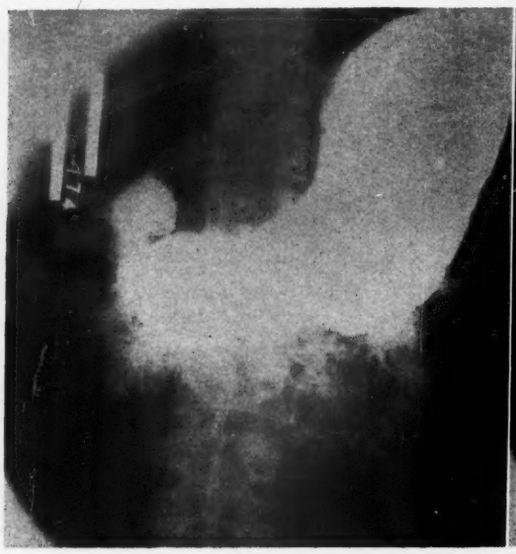


FIG. 1.

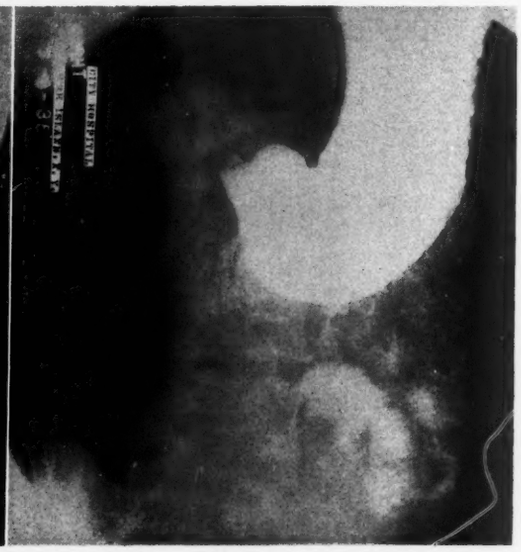


FIG. 2.

FIGS. 1 AND 2. Films taken in 1935 showing a long, rather well formed stomach, the only finding of unusual character being in the somewhat more vertical position assumed by the pylorus.

This is of some interest in that it seems to have been the direct factor which led to the discovery of "neoplastic" changes by *x*-ray and which actually produced the clinical and radiographic obstruction observed in the patient about whom we are reporting.

CASE REPORT

The case which we are here considering is that of J. S., a waiter, twenty-six years of age, single, who was born in New York City, and who was most recently admitted to the City Hospital on October 23, 1939.

By virtue of the chronicity and prolonged duration of his symptoms, he had previously been admitted to City Hospital on several occasions, and although completely and carefully observed at the time of these previous admissions no clue obtained to what now seems to have been the true etiological factor in his disturbance. At no time did his past or family histories seem to report any abnormalities with the exception of those included in the present illness and which are included in the summary of his case at the time of the most recent admission.

At that instant he was complaining of pain in the epigastrium which he reported to have been five years in duration, and of nausea and vomiting in spells which had continued over a period of seven years. The nausea and occasional vomiting were reported to have appeared at varying intervals, sometimes before, during or after meals, but apparently increasing in severity, and "increasing with psychic stress." After a period of a few months epigastric pain began to be noted which was constant in character and relieved only by drinking of milk. He continued to have this pain for a few years without other incident, until 1934 when he was hospitalized here, because of his complaints of gas pains after meals and constant epigastric pain, nausea and vomiting. *X*-ray findings at this time were reported as suggesting periduodenal adhesion. He was placed upon a Sippy diet and obtained considerable relief. He was again hospitalized in 1935 for a similar complaint and again obtained treatment of the same character with resultant relief. In 1936, because of reappearance of his similar com-

plaints. *X*-rays were again obtained with findings reported as entirely negative. His condition suggested a possible chronic appendiceal

FIG. 3.

FIG. 4.

FIGS. 3 AND 4. Films taken in 1937. The findings were not suggestive of any organic pathological condition. A comparison with the films of 1935, however, seems to indicate a suggestion of a shortening of the stomach and a shifting of the pylorus over the midline toward the left side.

focus and an appendectomy was performed without appreciable pathology being revealed in the tissue removed. However, he was somewhat improved following this operation, but was readmitted in 1937, not for the complaint referable to the stomach but because of constipation, which was quite difficult to control and readmission was accomplished in order to obtain additional *x*-ray examination. This was accomplished and no organic pathology found at that time.

About eight weeks prior to his last admission, he began to note the recurrence of his epigastric distress with frequent gas pain, aggravated by meals and most severe during the last six to eight weeks. About the same time he noted some brown vomitus, gradually increasing in frequency and amount, although on no occasion, apparently containing any bloody material. He did, however, note a gradual blackening of the stools beginning about one month before admission and reaching its maximum intensity about two to three weeks later. Following this they returned to their brown color. The vomiting during the past few weeks has been green in color but of diminished severity. Of late, milk had seemed to relieve his distress for periods lasting from five to ten minutes, following which the disturbance would reappear and even awaken him during the night.

At the time of his recent admission October 23, 1939 his temperature was 98.6°F. pulse 84, respirations 19 and blood pressure 122/80.

He was found to be a well developed but somewhat undernourished white male about 5 feet 6 inches tall, and weighing 130 pounds. He appeared somewhat anxious and depressed and frequently held the pit of his stomach with his right hand, though perfectly willing to be up and about the ward. His physical examination revealed normal findings with the exception that he had a somewhat scaphoid abdomen with point tenderness high in the epigastric area and a sense of resistance, but no definitely palpable mass. A right rectus scar, well healed, marked the site of previous appendectomy. No hernia could be detected. He had a hemoglobin of 58 per cent and a red blood count of 3,800,000; white blood cells 7,800, polymorphonuclears 68, lymphocytes 27, transitional 3, eosinophiles 2.

Blood typing was group A International; blood sugar was 100; blood phosphorous 3.63; blood phosphates 4.31; blood Wassermann

negative. Examination of stool shortly after admission was positive for occult blood, but subsequent re-examination was negative ten days later. Gastric analysis performed on October 24, 1939 revealed the following:

Fasting	15 Minutes	30 Minutes	60 Minutes
Free—no free hydrochloric	10	15	5
Combined 20	15	35	30
Quantity 25 cc	25 cc.	25 cc.	25 cc.

All specimens were very green with many lumps of mucus which gave a positive benzedrine test for occult blood.

A gastroscopic examination was accomplished on November 20, 1939 with the following findings: The antral mucosa was markedly reddened with a dull, dusky appearance. A small pyloric opening was glimpsed with respiration, but the antrum was marked by active peristalsis and somewhat distorted. White irregular solid material was adherent to the anterior posterior and lesser curvature boundaries at the entrance to the antrum. The entire gastric mucosa was reddened and angry in appearance, and in the mucous lake of the fundus globules of the same white foreign material were seen. The impression obtained was that of distortion of pylorus and antrum, marked superficial gastritis and some retention of solid foreign material.

FIG. 5.

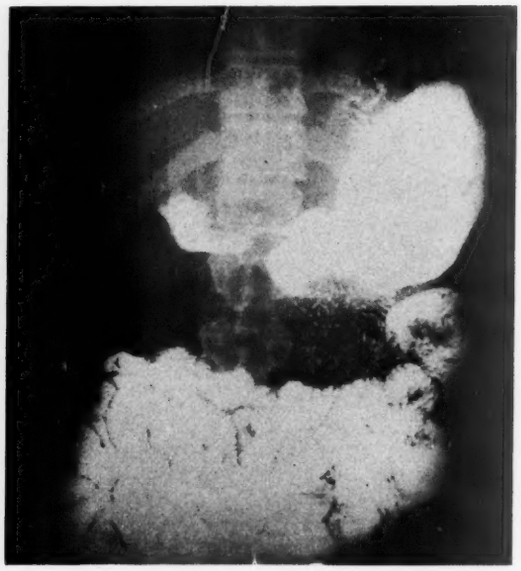


FIG. 6.

FIGS. 5 AND 6. Films taken in 1939, preoperatively. The shortening of the stomach and the shifting of the pylorus to the left is more noticeable than previously, together with a persistent deformity and lack of pliability of the pylorus.

A gastrointestinal series begun on October 26, 1939 showed the stomach to be of orthotonic type revealing along the lesser curvature and prepyloric region a projection of the outline which was irregular and through which no peristaltic waves passed. Near this a little barium collection indicated some degree of irregularity. The pyloric canal was elongated and rather stiffened. The cap was not well visualized. At six hours motility study showed marked gastric distention with food particles in the stomach. The head of the barium column was in the left half of the transverse colon indicating hypermotility. The tail was in the terminal ileum. This was considered evidence of an organic lesion in the prepyloric portion of the stomach with involvement of the pyloric sphincter. Because of location of the lesion a neoplastic condition had to be considered. In any event the lesion had interfered with the motility of his stomach and was causing partial

obstruction. At the end of twenty-four hours, re-examination revealed a gastric retention which had a mottled appearance. This was suggestive of either polyposis or retention of food. A re-examination accomplished on November 15, 1939 revealed a widening of the pyloric canal with the patency of the pylorus apparently fixed, and suggested the possibility of a hypertrophic pyloric sphincter, although the fixation did incline one toward the suggestion of infiltration, not necessarily on the neoplastic basis, as an old ulcer could have been capable of producing these findings.

Throughout the stomach there were translucent shadows circular in outline about the size of a marble which could be displaced from one part of the stomach to the other.

These apparently represented foreign bodies, and suggested balls of mucus that had been swallowed. The findings on this occasion were indicative of hypertrophy of the pyloric sphincter, fixation of the pyloric canal, which in all probability was due to an old infiltration secondary to an ulcer. There was moderate degree of obstruction caused by this condition, inasmuch as at six hours there was still considerable material in the stomach.

In view of these findings exploratory laparotomy was performed on November 28, 1939 with preoperative diagnosis of "chronic peptic ulcer, with secondary obstruction." On visualization of the stomach, an area on the anterior wall, about 6 cm. prepyloric appeared to be somewhat elevated and had the reddish discoloration similar to that seen in capillary hemangiomas upon the skin surface. Palpation revealed some thickening of the wall at this point to about four times the normal. This thickening extended for considerable distance beyond the area of coloration. In view of its neoplastic characteristics it was deemed advisable to resect the distal half of the stomach, this being done with the use of a Von Petz clamp, a gastrojejunostomy being performed with the stoma at the lower end of the line of resection. Following operation the patient had a mild postoperative course for four days when rather suddenly his temperature flared to 104°F., pulse to 110, and respirations 28. This began in the evening of the fourth postoperative day and by the morning of the fifth postoperative day temperature had come gradually down to normal levels.

There had been slight pain in the operative area during this time and a few râles were detected at both bases. In the afternoon of the seventh postoperative day temperature again suddenly rose to 105°F. There was complaint of extreme abdominal pain with sufficient evidence of peritoneal irritation to suggest the possibility of breakdown of the anastamosis. Exploration was suggested by some of the staff members, even though evidence existed in the respiratory passages which was felt sufficient to

Fig. 7. Fig. 8.

Figs. 7 and 8. Films taken postoperatively show complete removal of the pars pylorica and a portion of the duodenum, displaying a well functioning gastrojejunostomy.

account for the disturbance. A throat culture taken at this time was negative for pneumococcus, and revealed principally staphlococci. A blood culture taken at the same time was also negative. Patient was placed on sulfanilamide therapy and within forty-eight hours his temperature had returned to approximately normal levels. Shortly thereafter the patient was placed upon a soft diet and except for an occasional feeling of fullness in the epigastrium he had no complaint. Re-examination of the stomach by *x*-ray on December 15, 1939 showed complete removal of the pars-pylorica and portion of the duodenum with an enterostomy opening connected with the jejeunum. Barium was leaving the stomach slowly through the stoma but at the six-hour period the stomach had completely emptied.

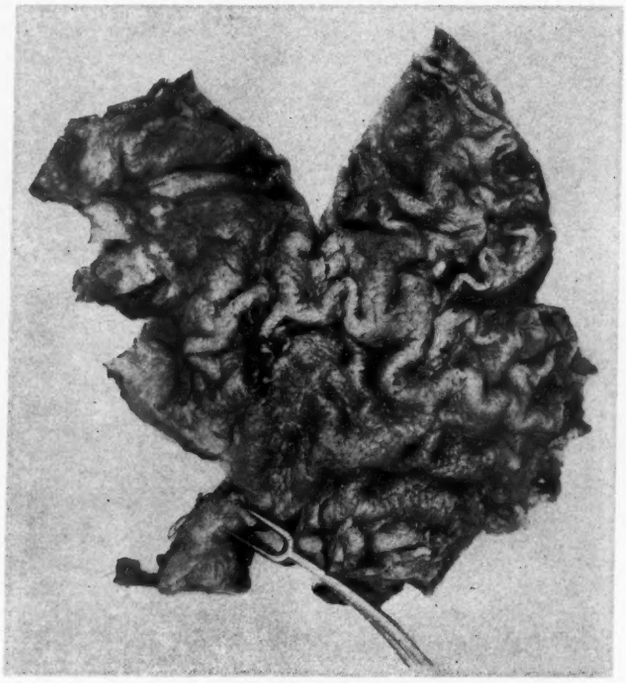


FIG. 9. Represents a photograph of the gross specimen. At the margin where the instrument is attached, there is a rather marked thickening of the wall of the stomach, particularly at those areas from which sections have been removed. It is possible to discern the hemorrhagic character of the serosa adjacent to the thickened regions.

The specimen of resected stomach measured 10 by 6 by 5 cm. The serosal surface was smooth and glistening throughout except for a well demarcated, raised, moderately firm hemorrhagic area. On opening the specimen the mucous membrane appeared normal throughout except in the region of the raised hemorrhagic area described on the serosal surface. Here a granular mass protruded into the lumen. The wall of the stomach in this area was markedly thickened. The mass described sectioned with great difficulty.

The microscopic section revealed a normal gastric mucosa moderately infiltrated with lymphocytes and plasma cells above a hyperplastic muscular coat. These were imbedded within the muscular coat and just beneath the serosal coat was noted a well encapsulated area of gastric mucosa surrounded by hyperplastic Brunner's glands.

A diagnosis was made of "Heterotopia of the duodenal mucosa (Brunner's Glands) and chronic gastritis."

Following his discharge from the hospital, the patient maintained a diet of frequent small meals and by January 20, 1940, had gained fifteen pounds in weight, remaining entirely symptom free.

It is naturally rather difficult to reveal in still photographs of *x*-rays all of these findings which are noted in fluroscopic examination and revealed by manipulation of tissues under examination. However, there

are several findings of interesting character which reveal themselves in a few chosen films which are displayed in the accompanying diagram. Figures 1 and 2 represent films taken in 1935; Figures 3 and 4, films taken in 1937; Figures 5 and 6 represent films taken in 1939, preoperatively, and Figures 7 and 8 represent films taken postoperatively. Figure 9 represents a photograph of the gross specimen, and at the margin of the specimen to which the instrument is attached the rather marked thickening of the wall of the stomach is discernable, particularly at those areas from which the sections have evidently been removed. It is even possible to discern the hemorrhagic character of the serosa adjacent to the thickened region. Figures 10 and 11 represent photomicrographs of the center of the involved region, displaying the enfolded stomach mucosa surrounded by the glands of the Brunner type, which in turn lie within a markedly thickened layer of muscular fibers.

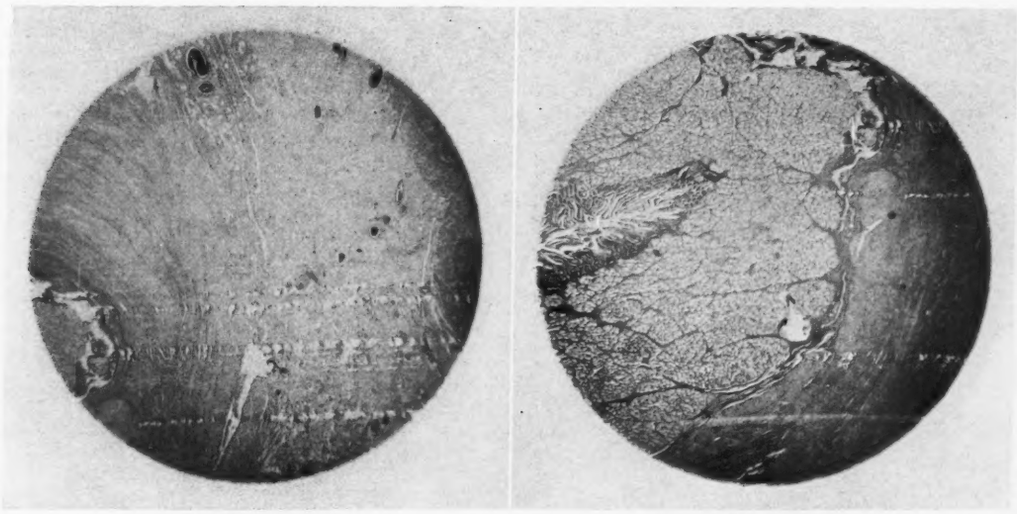


Fig. 10. Fig. 11.

Figs. 10 and 11. Photomicrographs of the center of the involved regions displaying the enfolded stomach mucosa, surrounded by the glands of the Brunner type, which in turn lie within a markedly thickened layer of muscular fibers.

The *x*-ray films show in 1935 a long, rather well formed stomach, the only finding of unusual character being in the somewhat more vertical position assumed by the pylorus. In 1937, the findings were not suggestive of any organic pathology. A comparison with the previous films, however, seems to indicate a suggestion of a shortening of the stomach, and a shifting of the pylorus over the midline toward the left side. This seems to be even more noticeable in the films taken in 1939, and together with the persistent deformity and lack of pliability of the pyloric end of the stomach, make up the most significant changes revealed in the plates themselves. Figures 7 and 8 represent the findings postoperatively and display the functioning gastrojejunostomy.

SUMMARY

A case of adenomyoma of the stomach, containing glands of the Brunner type and producing a tumor of the pyloric antrum which eventually led to obstruction and twenty-four-hour retention, is here reported. It follows in large part the characteristics demonstrated by other cases of similar type previously reported, namely, age incidence which seems to indicate a preponderance in young adults, the symptomatology which usually is indicated by gastric distress, nausea and even vomiting of chronic type in addition to absence or late appearance of *x*-ray evidence for

lesions which, by most pathologists, are considered to be developmental aberrations and, therefore, have probably existed in these areas over the entire lives of the involved individuals. Their clinical appearance and severity of symptoms seem to be in proportion to the overdevelopment of muscle fibers surrounding these lesions.

Special acknowledgment is due the kind co-operation of the late Dr. George J. Plehn, who carefully observed the entire series of *x*-rays and to Dr. James R. Lisa, who classified the tumor and assisted in the preparation of the section and photomicrographs.

REFERENCES

1. Gregory, A. *Zentralbl. f. Chir.*, 56: 1880, 1929.
2. Griep, K. *Zentralbl. f. Chir.*, 53: 2147, 1926.
3. Gruzdeff, D. A. *Med. Obozr.*, 71: 805, 1909.
4. Hilarowitz, H. *Zentralbl. f. Chir.*, 54: 1010, 1927.
5. Magnus-Alsleben, E. *Virchows Arch. f. path. Anat.*, 173: 137, 1903.
6. Petrowitch, M. and Davidowitch, S. *Bull. et mém. Soc. Nat. de Chir.*, 59: 1330, 1933.
7. Ramirez-Corria, C. *Compt. rend. Soc. de Biol.*, 95: 814, 1926.
8. Stewart, M. J. and Taylor, A. L. *J. Path. & Bact.*, 28: 195, 1925.
9. Stout, Arthur Purdy. Human cancer. 5: 96, 1932.
10. Wohlwill, F. *Klin. Wchnschr.*, 8: 2137, 1929.
11. Woolsey, John Homer and Millzner, Raymond. *Arch. Surg.*, 16: 583, 1928.

During the acute stage of poliomyelitis, it is not infrequent to encounter urinary retention, especially in adults. This is usually a transitory affair and can be alleviated by sterile catheterizations. After operations on the back or hip, urinary retention may complicate the postoperative course.
From—"Infantile Paralysis: Anterior Poliomyelitis"—by Lewin (W. B. Saunders Company).

OBSTETRICAL ANALGESIA IN PRIVATE PATIENTS

BERNARD J. HANLEY, M.D.
Associate Professor of Obstetrics and Gynecology, University of Southern California School of Medicine
LOS ANGELES, CALIFORNIA

THE use of drugs to produce analgesia and amnesia in labor has become increasingly popular. On the other hand, there is a distinct movement in the opposite direction supported by quite a number of experienced obstetricians. However, it is pretty generally agreed that the amelioration of pain during labor is desirable although the ideal analgesia is yet to be evolved. There are at the present time several methods that are reasonably satisfactory although none is entirely foolproof.

Common usage interprets the word analgesia to mean both a lessening of pain and loss of memory. This, of course, is not strictly correct, but will be used in this sense in this paper. Analgesia is an adjunct to obstetrical technic, not a panacea for many of its complications. When analgesia is resorted to, particular attention should be given to the occurrence of premature separation of the placenta and less frequent pathological conditions since they may be obscured by the use of drugs. The attending physician should be doubly watchful in order to exercise the best judgment in handling his responsibilities. Therefore, the maternal pulse, fluid intake and output, fetal heart tones, rupture of the membranes, dilatation and effacement of the cervix, engagement and descent of the presenting part should be given close attention. Any marked variation from the normal demands prompt treatment. Analgesia enables the patient to approach delivery with less fatigue than those who have to do without it. This is expressed by the maintenance of a normal pulse rate. This perhaps is due to the fact that the patient is able to sleep and relax between her pains.

I am reporting here 312 consecutive private patients treated during the past three years with nembutal and scopolamine. These are not routine cases. Frequently patients enter the hospital so far advanced in labor that only anesthesia can be given. I have not included in this series any cases delivered by cesarean section after a trial of labor. Having had experience with practically all other methods of analgesia I have found this combination of nembutal and scopolamine to be the most satisfactory to date. It has been used by me as a preoperative medication for spinal anesthesia for nine years. The state of mental relaxation in which patients came to surgery, and often maintained throughout the entire operation, has impressed me most favorably. Subsequent observations have confirmed this impression in regard to labor. Although nembutal was first used by me in combination with both scopolamine and an opiate, the latter was discontinued. I believe this analgesia to be safe in the hands of any conscientious physician. It can be used in either home or hospital with a minimum of equipment and personnel. I do not intend to discuss the pharmocology of these drugs. Their clinical actions have been carefully observed and recorded and there is nothing further to be added. I have purposely reported this private series in preference to a larger series conducted in charity institutions because inadequate physical facilities in the latter make it impossible to isolate patients and good analgesia is not readily achieved. Furthermore, in some charity institutions the patients pass through so many hands before delivery it is difficult to evaluate the efficacy of a drug.

In deciding to give analgesia one must realize that arguments have been raised against its use, especially those drugs that may cause apnea in the newborn. Schreiber[1] believes that when apnea is

present at birth an anoxemia is produced in the baby which, if prolonged, may cause a focal necrosis of brain cells. If this apnea is not fatal, later in life these children may show evidence of spasticity, have convulsive seizures or be mentally retarded. In his study, however, Schreiber has not considered the rôles of dystocia and hard forceps delivery, or the use of oxytoxics, any of which may result in cerebral hemorrhage, a recognized cause of apnea. Clifford and Irving[2] have shown that anesthesia may cause apnea in the newborn, especially when nitrous oxide-oxygen in ratios above 85:15 are used. Their results substantiate the work of Eastman. While the work of Schreiber makes us consider analgesia in a new light still his thesis has not been entirely proved. One must remember that various types of analgesia have been used successfully for many years. Observations by Bill, Irving, Danforth[3] and others upon large series of patients are not in accord with those of Schreiber.

METHOD

In choosing an analgesia several factors must be considered, the drugs used must: (1) be safe for both mother and baby; (2) be reasonably easy to administer; (3) not require special equipment or assistance, and (4) not be prohibitive in cost. I believe this combination meets these requirements and so at the beginning of her last month of pregnancy the patient is given 3 gr. of nembutal to see what her reaction is to this drug. If it produces a good sleep, there will be no contraindication in its use in labor provided she does not have an upper respiratory infection at the time of labor. As soon as labor has been well established, in other words, when the patient is aware of pain, she is given 6 gr. of nembutal by mouth and $\frac{1}{150}$ gr. of scopolamine hypodermically. The capsules of nembutal are punctured at both ends and given with a small amount of tepid water to aid in dissolving them and to provide quicker absorption. The room is then darkened and as far as possible all external noises are deadened, sideboards are fastened to the bed and an eyemask is put in place. A nurse is left in constant attendance. Usually the patient goes to sleep in from fifteen to thirty minutes. With each pain she will awaken, squirm about and then go back to sleep as the pain ceases. The length of analgesia depends on the rate of oxidation of the drug, severity and frequency of uterine contractions and other factors over which there is no control. Generally speaking, there was no relation between the dosage of nembutal used and the weight of the patient in this series. One dose usually provides relaxation and sleep for four to five hours. If delivery is not imminent, additional medication may be used. It has been my policy to give another 3 gr. of nembutal and if labor is prolonged a third dose of 3 gr. is added. If scopolamine is repeated, I give $\frac{1}{200}$ gr. Only in a few instances was it necessary to resort to opiates in the hope of relaxing a rigid cervix and giving the patient additional rest. The dosages used are shown in Table 1.

TABLE 1
DOSAGE

Drug	Primiparae	Multiparae
Nembutal gr. 6 and scopolamine hydrobromide gr. $\frac{1}{150}$	112	81
Nembutal gr. 6 and gr. 3 and scopolamine hydrobromide gr. $\frac{1}{150}$	81	26
Nembutal gr. 6, gr. 3, and gr. 3 and scopolamine hydrobromide gr. $\frac{1}{150}$	8	4
Additional opiate—dilaudid gr. $\frac{1}{32}$	4	3
Additional scopolamine hydrobromide gr. $\frac{1}{200}$	6	2

DELIVERY

All patients were delivered under ether or gas anesthesia after a routine episiotomy. The cervix was inspected and repaired when found necessary. It is my custom routinely to deliver patients with outlet forceps when the head comes on the perineum. Unquestionably, more of these

cases would have delivered spontaneously had I chosen to wait. The methods of delivery are shown in Table II.

TABLE II
METHODS OF DELIVERY

Delivery	Primiparae	Multiparae
Spontaneous	49	69
Outlet forceps	133	26
Mid forceps	7	4
Version extraction	0	4
Breech extraction	12	8

RESULTS

In evaluating the effect of the analgesia used here I have classified them arbitrarily as good, fair and poor. While I appreciate that this is not very scientific, I believe nevertheless that they convey a fair meaning of the reaction of the patients. It goes without saying, however, that one might expect better results from the use of this analgesia if the patients could be isolated in a soundproof room and have a trained personnel to observe them. The conditions under which these labors were conducted were not ideal but still reasonably good. The results are shown in Table III.

TABLE III
RESULTS

	Primiparae	Multiparae	Percentage
Good	175	82	82
Fair	16	24	13
Poor	10	5	5

MATERNAL COMPLICATIONS

No deaths occurred in this series. One patient had a moderately severe postpartum hemorrhage four hours after delivery which I believe was in no way connected with the analgesia. She had had a postpartum hemorrhage following her first delivery in which neither analgesia or anesthesia was used. Eight of the patients who were in hard labor over twenty-four hours became very restless and so difficult to manage that seven of them were given an opiate. Each of these eight had received 12 gr. of nembutal and I did not wish to give them any more. One patient had a mild sepsis from a retained cotyledon which subsided when the cotyledon passed spontaneously. One patient developed a severe pyelitis on the sixth postpartum day. She recovered quickly under sulfanilamide therapy. It would not seem that either of these infections was in any way related to the analgesia. All mothers were discharged from the hospital in good condition.

FETAL COMPLICATIONS

One baby was stillborn. This was a breech presentation and death was due to the umbilical cord becoming impinged between the buttocks of the fetus and the sacral promitory of the mother. The fetal heart was not heard before delivery and death was in no way related to analgesia. One baby had an intestinal obstruction requiring surgical relief on the seventh day. He recovered. One baby, delivered by podalic version and extraction, was a mild hydrocephalic and subsequently died at the age of seven months. Twelve babies, 0.4 per cent, showed evidence of asphyxia at birth, six of whom required the use of a tracheal catheter for resuscitation, while the other six responded to carbogen inhalations. Five of these twelve babies were delivered by mid-forceps after long labors which may account for the asphyxia. These twelve cases showed no subsequent evidence of asphyxia. However, there were three other babies who breathed spontaneously at birth and several hours later had attacks of cyanosis. They responded immediately to carbogen and received no other treatment. No further attacks occurred after leaving the hospital. These three babies have been closely followed for over two years and are normal in all respects. While latent attacks of anoxemia following the use of analgesia have been

reported, further investigation is necessary to confirm this hypothesis. A fairly large clinical experience in patients who have had neither analgesia nor anesthesia has taught me that attacks of cyanosis in the newborn are not uncommon.

SUMMARY

1. A series of 312 private cases of labor are reported in which nembutal and scopolamine were used to induce analgesia. Good results were obtained in 82 per cent. Most of the patients failing to respond were in hard labor before analgesia was started and hence the drugs had insufficient time to induce sleep.

2. There were no severe maternal complications in this series. Ten patients were markedly restless and difficult to control. One baby, 0.32 per cent, was stillborn due to a prolapsed cord which was in no way related to analgesia. Six babies were deeply asphyxiated at birth and required the use of a tracheal catheter for resuscitation. Six other babies who showed evidence of asphyxia responded to carbogen inhalations.

CONCLUSIONS

The combination of nembutal and scopolamine, in the dosage described, can be used with safety to induce analgesia in labor. Patients with this type of analgesia require *constant supervision*. The length of the first stage of labor is not increased, the length of the second stage of labor may be increased due to lack of co-operation with the expulsive powers, hence more outlet forceps are necessary. A small percentage of the babies will require artificial methods of stimulation to establish respiration.

REFERENCES

1. Schreiber, F. J. *J. A. M. A.*, 111: 1263, 1938.
2. Clifford and Irving. *Surg., Gynec. & Obst.*, 65: 23, 1937.
3. Bill, A. H. *Am. J. Obst. & Gynec.*, 34: 868, 1937; and Danforth, W. C., *M. Rec. & Ann.*, 30: 717, 1936.

METHYLENE BLUE AS AN INDICATOR FOR THE ORAL ADMINISTRATION OF FOOD TO THE SURGICAL PATIENT

BENJ. I. GOLDEN, M.D. AND J. E. MARTIN, JR., M.D.
Chief Surgeon, Davis Memorial Hospital — Associate in Medicine, The Golden Clinic
ELKINS, WEST VIRGINIA

UNTIL recently, the accepted purpose of surgery was to alleviate pain by the removal of the affected part. Later, it became evident that not only was the part to be removed, but that the re-establishment of normal physiological functions as necessary. This brought about the present evolution of surgery and the appreciation of the fact that the technical procedure was merely an incident in the processes of rehabilitation of the patient. With simplification of laboratory technics, refinements in the preoperative and post-operative evaluation of the patient, have become almost routine. However, as we read the literature of the day, one is impressed with the continuous and deliberate neglect of certain well established principles. Statement of some of these will not be universily accepted; yet their truth cannot be denied. For example, in cases of peritonitis, it is advised not to feed the patient; use morphine freely and keep the patient at rest. An examination of these statements demonstrates a most controversial condition. Lack of food in the gastrointestinal tract is conducive to the production of gas and supsequent distention. Distention interferes with both digestion and absorption, reduces blood supply and osmosis, thereby reducing the normal resistance of the intestinal tract. The theory is that food will increase motility and either reduce resistance or spread infection. Yet we know that there is always residue in the intestinal tract, that a great bulk of the feces is composed of bacterial débris and failure to maintain the proper relationship of certain factors in the lumen permits certain bacteria, which normally are harmless, to become pathological. The use of morphine again demonstrates the application of known facts. Morphine does not inhibit peristalsis but, on the contrary, brings about a more normal rhythm. That peristalsis is definitely of value is conclusively demonstrated by the use of spinal anesthesia. Most surgeons will admit that it is the anesthesia of choice in general peritonitis. Certainly one cannot argue that the brilliant results are all obtained from the lessening of shock alone. Thus the conclusion is: Certain of the principles now adhered to for postoperative care are groundless. The important factors in the care of such patients are to know definitely that the intestinal wall is completely viable and absorption is normal. Without this information, all methods of care become empirical.

More recently, the brilliant results of so many workers in water balance, high protein maintenance and proper evaluation preoperatively of the patient, established beyond doubt the necessity for proper preoperative physiological preparation of the patient. While these facts are well known and the literature is filled with modern advances, too frequently the application becomes a mere routine with no attempt to evaluate the patient by using the simple laboratory procedures which are now at our command. The free use of infusions and transfusions often burdens an already laboring physiological machine and the reaction becomes too much for the patient; thus we are guilty of aiding a stormy convalescence rather than relieving it. Methods developed to sustain the patient during the reaction period have been

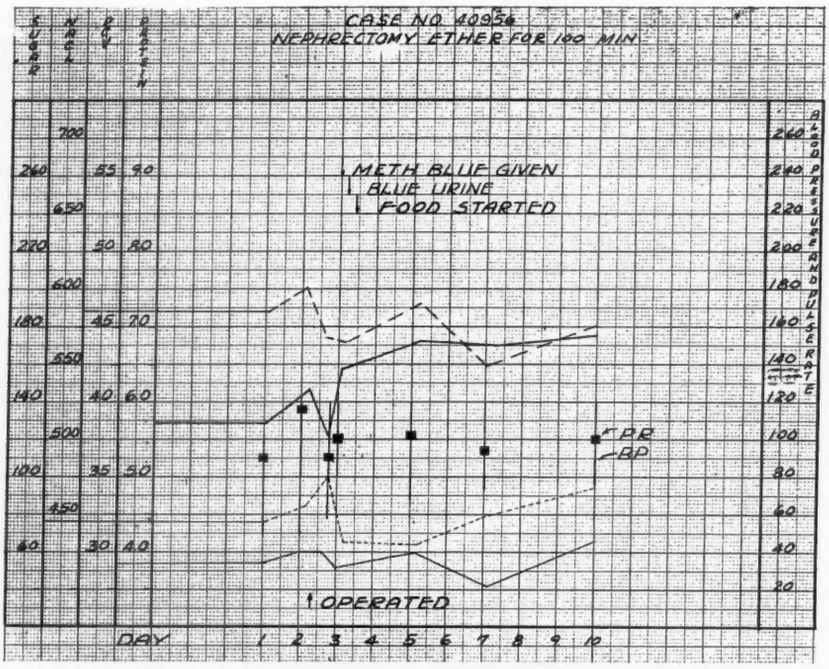


FIG. 1. Case No. 40956. An eighteen year old female, three and one-half months pregnant. She had a nephrectomy for a hydronephrosis. Methylene blue was given about seven hours postoperatively and blue urine was obtained within three hours. Food was started the next morning. The patient did not vomit and had a smooth convalescence. Note the gradual increase in the plasma protein and the packed cell volume during her convalescence. The patient was discharged with pregnancy undisturbed.

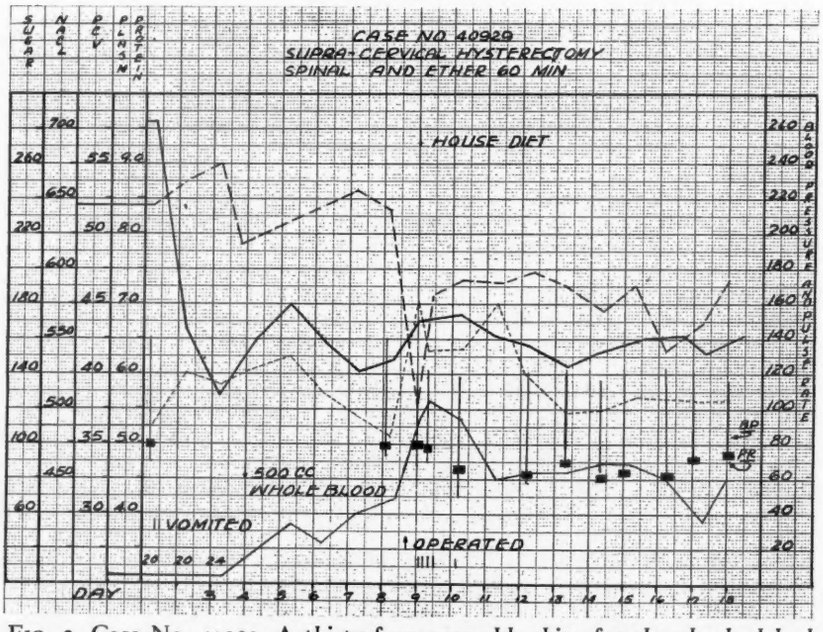


FIG. 2. Case No. 40929. A thirty-four year old white female who had had vaginal bleeding for two years. A supercervical hysterectomy was done under combined spinal-ether anesthesia. Before operation she received one transfusion of 500 cc. of citrated blood. Methylene blue was given three hours postoperatively and blue urine obtained in three hours. Food was started immediately. She vomited several times but did well during her convalescence. There was little change in the blood pressure and plasma protein after operation.

demonstrated of moderate value. It still remains apparent that the oral administration of food is the only method of feeding, possible, how serious, and whether it was complete. A dye seemed the most likely indicator. Methylene blue was the final

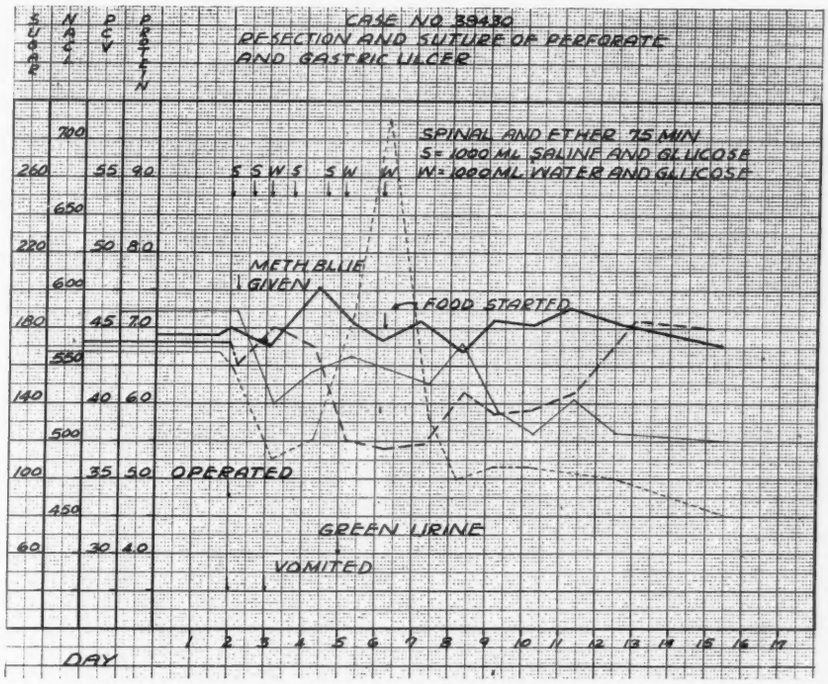


Fig. 3. Case No. 39430. A thirty-six year old white male who had suffered a perforation of a gastric ulcer about six hours before operation. Methylene blue was given the day after operation but no blue urine was obtained until the third postoperative day. In consequence, food was not started and he was given several intravenous injections of glucose and saline. After green urine was obtained he was able to take food without discomfort. He made an uneventful recovery. No further intravenous medication was necessary after food was started.

compatible with normal metabolism. To date, the decision as to when to feed the patient has been based on empirical deductions.

Early in 1928, we started to feed the postoperative patients as soon as nausea and vomiting stopped. We found that there was a marked reduction in postoperative morbidity. However, we were of the opinion that some method could be devised which would give us a physiological basis for this decision. Nausea and vomiting need not necessarily mean that the patient could or could not take food. Our problem was to ascertain that the intestinal tract was absorbing and the kidneys were functioning. An effort was made to find some method to determine, not only these facts, but should there be a break in the chain, if choice. While little is known concerning absorption and secretion of the dye, it is known to be harmless, and in the quantities used, certainly could not harm the patient.

This preliminary report is based on the observation and study of approximately one hundred patients with all types of surgical procedures. The charts herein presented represent no special cases but rather a diversified group of surgical technics. The dye, 1 gr. in capsules, is given by mouth from six to eighteen hours postoperatively. The patient is requested to void prior to its administration; if he cannot, he is catheterized. At the time of administration of dye, as much water is given as can be comfortably taken. During the next three hours, small amounts of water are given repeatedly. After three

hours, the patient is encouraged to void. If there is failure, he is catheterized at the end of five hours. If greenish-blue urine is obtained, we assume that the ability of the intestines to absorb and the kidneys to secrete, has been established and we proceed to feed by mouth. We know that in chronic cystitis, the color of the urine will wash out rapidly, hence these bladders must be emptied often. It is stated that in certain types of nephritis, the color will not be secreted. To date, this has not occurred in our series and therefore, we cannot comment. Normally, color should appear in the urine in about ninety minutes. Since we believe catheterization should not be encouraged, we seek a specimen in from three and one-half to five hours by voiding. Observation has taught us that failure to obtain this secretion of the dye invariably means a sick patient. Also, a weak color is a signal to go slow with oral feeding.

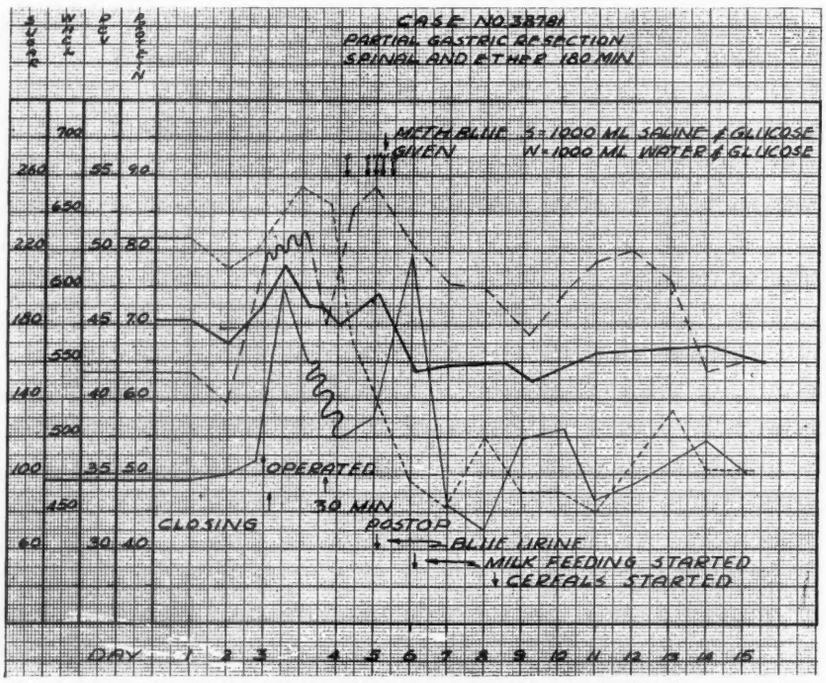


FIG. 4. Case No. 38781. A thirty-three year old male who had had two previous repairs of perforated gastric ulcers. At the time of this operation he was suffering from a partial pyloric obstruction. We call to your attention the marked reduction in packed cell volume and plasma protein caused by the administration of five liters of intravenous solutions over a period of seventy-two hours, not an unusual quantity as these solutions are given routinely today.

Methylene blue was given shortly after operation and blue urine was passed within three hours. As this was one of our first cases, food was not started until sometime later. Notice that there is an almost immediate increase in packed cell volume and plasma protein after food by mouth is started; furthermore, the wide fluctuations in all values tend to be reduced.

The criticism offered to this technic can be stated that the part operated upon is not sufficiently healed to withstand food and digestion. We believe this is contrary to existing knowledge. Even though a partial gastrectomy has been done, the stomach continues to secrete and the digestive juices to regurgitate. In fact, one of the outstanding methods in the care of the patient with a gastric ulcer is to place the stomach at rest by feeding. We would admonish those who apply this method to use judicious application and feed according to requirements and ability of the patient.

Since the application of methylene blue, we have observed marked reduction in

wound infections, postoperative nausea and vomiting and have almost eliminated the use of the Wagensteen appliance. The accompanying charts illustrates these points.

The values given in the figures are: The thick solid line represents plasma protein as determined by the falling drop method of Barbour and Hamilton; the thin line represents the packed cell volume as determined with the Wintrobe tube; the dotted line represents blood sugar as determined by the Folin-Wu method adapted to the photoelectric colorimeter; the broken line represents blood sodium chloride as determined by modification of Mohr's method.

SUMMARY

We present a rationale for early feeding and the discrepancies of many of the arguments advanced against it.

A method for ascertaining the physiological re-establishment of the absorption of the intestinal tract and the function of the kidneys is presented.

The use of methylene blue, an innocuous dye, as the indicator and the admonition against free feeding without adequate study of the patient are also presented.

An essential principle in the care of compound fractures is that no treatment of the wound itself should be allowed to interfere with correct splinting.
From—"Wounds and Fractures"—by Orr (Charles C. Thomas).

TENDON INJURIES*

A STUDY OF ONE HUNDRED AND SIXTEEN CASES

DONALD H. HOOKER, M.D. AND CONRAD R. LAM, M.D.
DETROIT, MICHIGAN

THERE are few fields in surgery that are so prone to produce disappointment as that of the tendons and nerves in and near the hand. Few writers on the subject are satisfied with their own results, but they are encouraged by the increased percentage of satisfactory outcomes which appears to be due to intensive study of the problems involved, and continued experience in the operative technic. As an example of the careful and effective work which is being done on the surgery of the hand, one must mention that of Koch and Mason.[1] They stated, "A few patients have secured a perfect functional result and it is such cases particularly that encourage us to keep on trying to perfect our technique to such a point that we can in fairness hold out to every patient with division of nerves and tendons the reasonable assurance of a satisfactory result." Following are two case reports from our series which serve as a reminder that "it can be done":

CASE REPORT

CASE I. R. S., a sixteen year old student in a trade school, sustained a laceration on the volar surface of the left forefinger over the proximal interphalangeal joint. Examination showed that no voluntary flexion of the interphalangeal joints was possible, and the diagnosis of section of the flexor profundus and sublimis tendons was obvious. The hand was carefully cleansed, and operation was begun under local anesthesia two hours after the accident. The profundus tendon only was sutured, using the method preferred by Koch and Mason, which will be described below. The finger was maintained in flexion by a light metal splint on the dorsal side, but after two days, this splint was removed daily by the patient, and active motion was given to the finger. The laceration healed satisfactorily in spite of the fact that the wound lay in the crease where extension tended to open it. The splint was discarded at the end of six weeks. The result at the end of eight weeks is shown in Figure 1. This is a very satisfying result from the suture of a flexor tendon within the finger, a location which gives the poorest number of good results, as will be seen in the analysis of results below.

CASE II. E. B., was a twenty-eight-year old man who cut his right wrist on the glass of a car window. The following injuries were sustained: complete section of flexor carpi ulnaris, flexor carpi radialis, palmaris longus, flexor pollicis longus tendons, all of the superficial and deep flexor tendons of the fingers, the ulnar artery and the ulnar and median nerves. The operation was done under local anesthesia by Dr. George Wadsworth. All of the tendons except the palmaris longus were united by suturing with silk according to the method of Bunnell. The artery was ligated and the nerves were sutured in the usual manner. The wound healed by primary intention. Active motion was begun during the first week, and after healing had progressed to a safe degree, physiotherapy was used generously. Almost perfect motor function of the fingers resulted, as may be seen from the follow-up photographs in Figure 2, taken fifteen months after the injury. At this time, there was still some impairment of sensation as a result of the nerve injuries.

In this analysis, 116 cases of primary tendon suture were studied. One hundred five of these were in the hand and wrist; the others were in the ankle and foot. Men sustained this injury five times more frequently than women. The age group most frequently involved was that of the third decade. The right and left hands were equally involved. Injuries of the hand

* From the Division of General Surgery of the Henry Ford Hospital, Detroit.

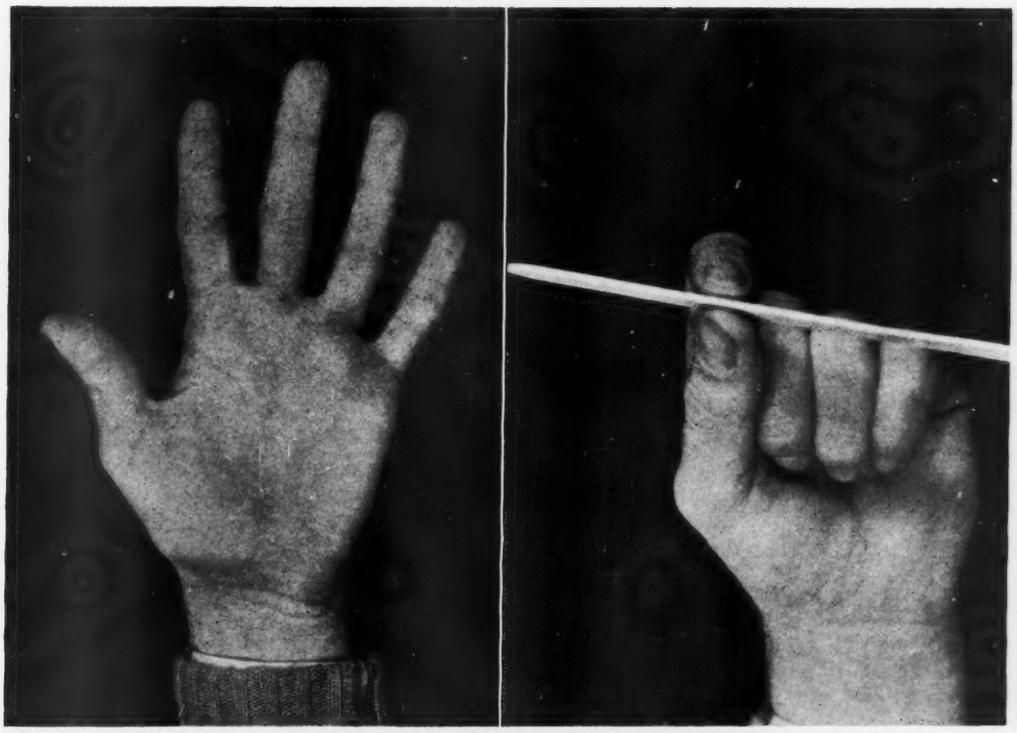


Fig. 1. Case 1. Result obtained following suture of flexor tendon of the left forefinger at the proximal interphalangeal joint.

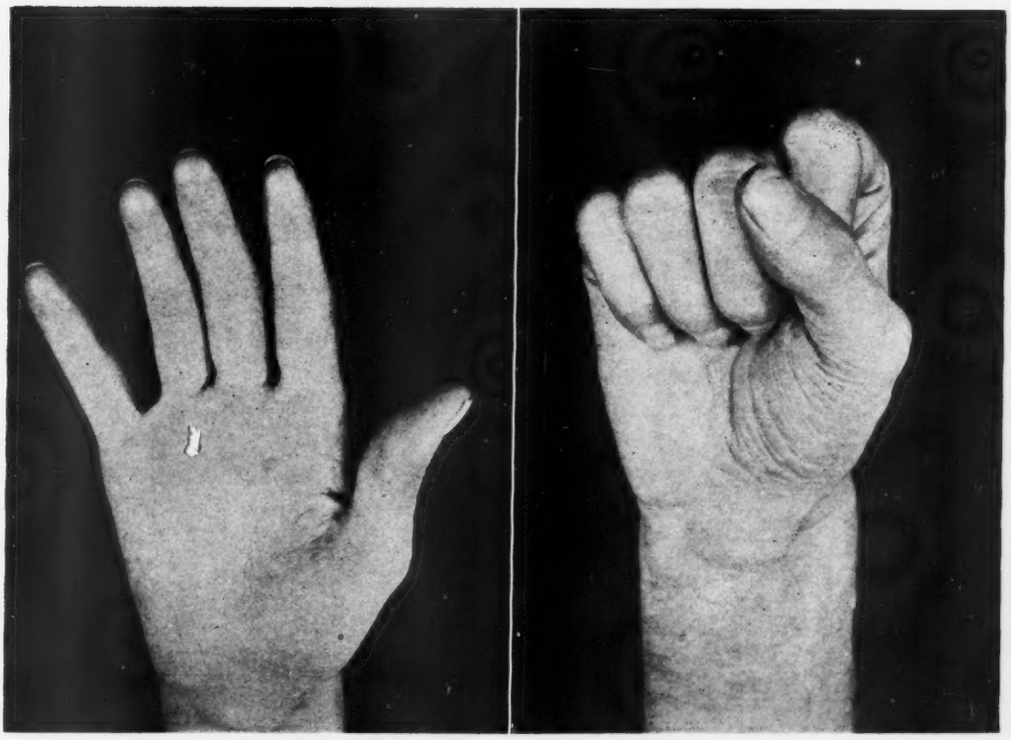


Fig. 2. Case 11. End result following repair of all of the flexor tendons of the hand.

were encountered a little more frequently than those of the wrist or fingers, and almost two-thirds of the cases involved the flexor tendons.

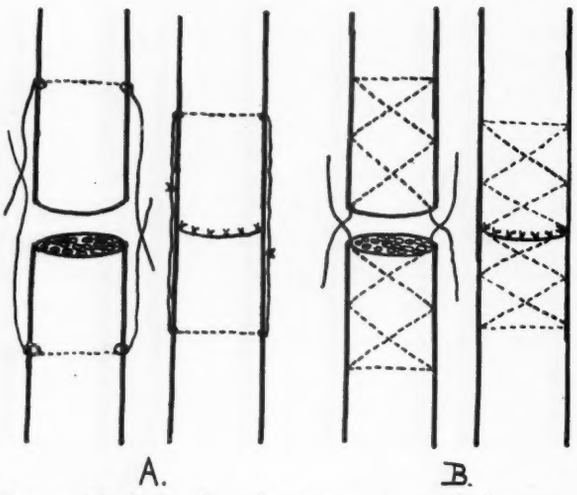


Fig. 3. Methods of tendon suture; A, method recommended by Koch and Mason; B, Bunnell's method. (After Koch and Mason.[1])

Table 1 shows what the patients were doing when they sustained the tendon injury. The high percentage of industrial cases is undoubtedly peculiar to the Henry Ford Hospital. The industrial injuries were usually of a crushing type, since they were caused by falling machinery, the punch press, rebore and tool machines. Many were complicated by fractures of the metacarpals and loss of skin which created problems of closure and fixation. Household injuries were invariably clean lacerations, produced by knives, razors, porcelain water faucet handles and broken glass. The athletic injuries were subcutaneous ruptures of various tendons.

Table 1
TYPES OF INJURY

	No. Patients	Percentage
Industrial	62	53.4
Household	35	30.2
Automobile	14	12.1
Athletic	5	4.3
	116	100.0

Table 11 shows the results that were obtained when operation was undertaken after various periods of time had elapsed. It is, of course, difficult to define criteria for the classifications of "good, fair, and poor." However, an attempt at classification seems justifiable. The patients with "good" results had hands which functioned adequately with no disability for their work. Range of motion in fingers was from 75 to 100 per cent of normal. Patients with "fair results" had some motion in the involved fingers, but this motion was short of satisfactory and caused some disability. Some of these patients were dissatisfied, and would consent to a second operation if they could be promised better function. Others were well pleased with the status quo. The patients with "poor" results had little or no motion in the involved fingers and most of the original disability persisted.

Table 11
INTERVAL BETWEEN INJURY AND OPERATION (UPPER EXTREMITY ONLY)

Preoperative Interval (Hours)	Results			
	Good	Fair	Poor	Total Cases
1 to 4	33	15	5	53
5 to 8	6	7	4	17
9 to 12	5	9	9	23

That the duration of a tendon injury preoperatively bears a direct relationship to the end result, has been repeatedly emphasized. Koch and Mason believe that primary repair of flexor tendons of the hand should not be attempted more than four hours after an injury. It is possible to delay longer in the case of extensor tendons, and O'Shea[2] sets his limit at eight hours. Table 11 shows the remarkably better prognosis with early operation, within four hours, and the inadvisability of operative intervention after eight hours.

Table 111 shows again the well known fact, that the more distal the cut in the tendon the worse the prognosis. The poor

results from the suturing of tendons within the finger is especially challenging; and when such an injury is encountered, the best hand surgeon available should be enlisted to do the operation. Indeed, the suturing of a flexor tendon anywhere in the hand or wrist is a major procedure, requiring specialized technic and aptitude, comparable to that possessed by ophthalmic and brain surgeons.

Table III
RESULTS WITH FLEXOR TENDONS IN THREE LOCATIONS

Location of Injury	Results			
	Good	Fair	Poor	Total Cases
Wrist	14	4	2	20
Hand	7	9	5	21
Finger	2	5	12	19

Table IV shows that it is a different story when one is dealing with tendons on the dorsum of the hand, i.e., the extensors. The tendons may be united by any one of a number of different methods. The loose skin and areolar tissue of the back of the hand permits motion in the presence of adhesions and such adhesions almost always disappear in a year or two.

Table IV
RESULTS WITH EXTENSOR TENDONS IN THREE LOCATIONS

Location of Injury	Results			
	Good	Fair	Poor	Total Cases
Wrist	2	3	0	5
Hand	13	7	2	22
Finger	10	4	0	14

Infection. Infection of the wound following tendon suture about the hand is a dreaded complication. The incidence of infection reported by various authors has been rather high. With improved technic and the use of local chemotherapy, a reduction in the rate of infection is to be expected. In Buxton's[3] series, approximately 15 per cent were infected. O'Shea reported an incidence of approximately 13.3 per cent; infection was six times more frequent when catgut rather than silk was used in the suture (one hundred thirteen cases in the series). In the series of Eisberg and Sonnenschein,[4] there were seven infections in fifty-eight cases, or 12.1 per cent approximately. In our series of 116 cases, eleven cases became grossly infected, requiring surgical drainage of suppuration, hot compresses and other surgical attention. Twenty other cases did not heal by primary intention, there being superficial infection of the skin margins. The noninfected cases gave six times as many good results as poor, while the infected cases gave twice as many poor results as good.

Since 1930, silk has been the only suture material to be used in tendon surgery in the Henry Ford Hospital. Previously, some cases were done with catgut. Comparison of the cases done with the two suture materials shows that good results were 40 per cent more frequent when silk was employed. It could not be demonstrated that the type of anesthesia or the clean-up method affected the incidence of infection or the end results. Local and general anesthetics were used with equal frequency.

Tendons of the Foot. These injuries included lacerations of the tibialis anticus tendon, the achilles tendon and the flexors and extensors of the toes. In eleven cases, there were ten good results. These tendons appear to be much easier to deal with than those of the hand.

RECOMMENDED PROCEDURE FOR TENDON SUTURE IN THE HAND

There is nothing original in the operative procedure about to be described. It is essentially the procedure which Koch and Mason have presented many times. The matter of the time interval has already been discussed. Operation should be done within a four-hour period, otherwise the wound had better be sutured and the tendon repaired several weeks later. A painstaking examination of the

hand to determine the total extent of tendon and nerve injuries before beginning the operation is stressed. Such a painstaking examination will take less than five minutes if one is familiar with the anatomy. The hand is washed with tincture of green soap and copious amounts of water for ten to fifteen minutes. The nails are carefully cleaned. The wound itself is irrigated with a liter of saline solution.

The operation is done in a regular operating room, with two assistants for the surgeon, and an instrument nurse, preferably one who is familiar with the operation of tendon suture. General anesthesia is usually preferred, but local anesthesia may be employed. Both of the cases reported in this paper were done under local anesthesia. A blood pressure cuff is used for a tourniquet, in cases in which a general anesthetic is given, thus giving a bloodless field for exploration. The pressure is released every half hour for a short interval.

Needless to say, the operation should be carried out with meticulous attention to the details of atraumatic surgery which have been emphasized by writers on this subject and other aspects of wound healing. One should use sharp dissection when possible. Tissues should be handled with extreme care. Hemostats should grasp a minimum amount of tissue, and they should be replaced by a tie of fine silk cut short.

For the suturing of the tendon itself, we prefer the method described by Koch and Mason, as illustrated in Figure 3. In the diagram, this may not look as effective as the method of Bunnell, since there is more suture material outside the tendon. However, it is easier to apply, and our recent experience is tending to show that it gives the best results. The ends of the tendons are caught with Allis clamps, crushing as little tissue as possible. The ends are matched up, and while the tendons are steadied with the clamp, the main suture is placed, usually with a small curved cutting needle. No. 1 braided silk is used for this suture. As soon as each suture is placed, the part of the tendon crushed by the clamp is cut away with a brisk stroke of a sharp scalpel, leaving a clean transverse surface for approximation. The corresponding ends are firmly approximated by tying the appropriate tension sutures, after which several interrupted sutures of No. 00 fine silk are placed to complete the repair.

Little can be accomplished in trying to close tendon sheaths. The less silk is left buried, the better. The skin is closed with interrupted sutures of medium silk. The hand is splinted in a position of complete relaxation for the tendons involved, but motion is encouraged and insisted upon after two days. The period of hospitalization varies from none to ten days. Some cases with injuries to extensor tendons are not kept in the hospital after suture. Patients who have had suture of the flexor tendons remain in the hospital about a week, after which they are seen in the outpatient department at two-day intervals. It has been assumed that healing is fairly complete at six weeks.

SUMMARY

1. One hundred five tendon injuries of the hand and wrist and eleven tendon injuries of the foot have been analyzed for factors bearing on the end results.

2. The importance of early operation, avoidance of infection and the use of silk as the suture material has been demonstrated again.

3. The difficulties involved in suturing flexor tendons, especially those of the fingers, have been stressed.

4. Two cases are reported in detail.

5. A summary of the procedure recommended for tendon suture is presented.

REFERENCES

1. Koch, S. L. and Mason, M. L. Division of nerves and tendons of the hand. *Surg., Gynec. & Obst.*, 56: 1, 1933.
2. O'Shea, M. C. Severed tendons of the hand and forearm. *Ann. Surg.*, 105: 228, 1937.
3. Buxton, St. J. Prognosis after injuries to tendons. *Lancet*, 2: 1179, 1937.
4. Eisberg, H. B. and Sonnenschein, H. D. Primary repair of lacerated tendons and nerves. *Am. J. Surg.*, 3: 582, 1927.

LEUKOCYTE EXHAUSTION IN INTESTINAL OBSTRUCTION*

FRANKLIN I. HARRIS, M.D. AND
Senior Associate Chief Surgeon, Mount Zion Hospital
SAN FRANCISCO, CALIFORNIA

CAPTAIN JEAN SPENCER FELDHEYM, M.D.
Station Hospital
FORT LEWIS, WASHINGTON

LEUKOPENIA has long been known as a constant accompaniment of certain disease processes and as the result of numerous forms of poisoning, i.e., benzol, arsphenamine, radium, etc. Drugs such as sulfanilamide and sulfapyridine have left in their wake isolated instances of marked depression of the bone marrow and numerous hemopoietic disorders display a considerable thinning of the leukocytic stream. The appearance of leukopenia following the release of an intestinal obstruction is an observation which has not been previously noted or reported as one of the findings in the course of a rectified obstruction. It is the purpose of this paper to present a series of cases in which there occurred a marked lowering of the leukocyte level following the release or removal of the bowel obstruction. In the literature blood chemistry studies have been reported frequently from patients who present either a mechanical or a paralytic type of ileus, but accurate hemograms have not been reported on such patients in the early postoperative period when a fall in leukocytes may manifest itself.

Ordinarily, an initial count of the white blood cells is done on the patient's admission to the hospital as a diagnostic procedure, but rarely are the hematologic studies continued or repeated following either medical or surgical treatment, as it has been believed most likely that additional blood examinations are unnecessary as a factor in therapy, apart from their value in complications. Thus the possibility of disclosing a leukopenic state is usually missed and such a hematologic condition goes undiscovered.

In numerous case compilations and collected series the leukocytic changes which we are about to describe, has gone completely undetected. Wangensteen[1] in his monograph states that "Little specific help in the diagnosis of obstruction is obtained in general laboratory procedures. When vomiting has been a prominent feature, concentration of the blood occurs and increased values for hemoglobin, red cells, and leukocytes may be found." And again, "occasionally, leukocytosis may be absent altogether in infection and leukocytosis is usual following trauma, after hemorrhage and processes which cause severe dehydration." No mention is made in the work of the state of the blood in this particular regard at the time of the release of the obstruction.

Vidgoff[2] states that in 266 cases of obstruction leukopenia was the "rule" because of the marked toxemia. However, his average count was 7,900 with 79 per cent polymorphonuclears, coursing as high as 28,000 in some instances. These counts were all preoperative. Russel[3] believes that blood studies reveal leukopenias in this condition, but this is given as a diagnostic aid only without subsequent leukocyte counts being made. Watson and Sargeant[4] discuss a well known fact, the low leukocyte count in pyogenic infections, appendicitis being one, and offer the possibility of the marked sepsis as the cause of the depletion of the white cells through repeated call of cells to the infected focus at a rate faster than their production by the bone marrow, a fact indicative of a very poor prognosis.

Cornell[5] in a series of 235 cases at the New York Hospital found the average

* From the Surgical Service of the Mount Zion Hospital, San Francisco.

white cell count to be 15,445 with 80 per cent polymorphonuclear forms in intestinal obstruction. These counts also were preoperative counts. Rentschler[6] claims that in 100 cases cited, a normal leukocytic picture is seen depending upon the extent of the dehydration secondary to the vomiting. Of the series of Workman and Miller,[7] the white cells averaged 11,388 in thirty cases of simple obstruction and 12,886 in twenty-eight cases of obstruction with strangulation. In the Cook County Hospital compilation of Fey and Cubbins,[8] all of the 241 cases demonstrated a definite leukocytosis ranging from 10,000 to 20,000. However, in all the above quoted reports the counts appear to be preoperative counts.

We are presenting a series of ten cases of small bowel obstruction in which daily white blood counts were made following operation and in all of which was noted a marked leukopenia in the immediate postoperative period of from one to seven days. This leukopenia was not associated with surgical sepsis nor did it indicate necessarily a fatal prognosis as six out of these ten patients recovered. Although these ten cases are selected from a total of 185 cases of intestinal obstruction encountered in an eight-year period, they represent the only cases in the total group in which daily white blood counts were done in the immediate postoperative period. We, therefore, believe that this leukopenia would be more often noted in any large series of cases of obstruction if daily postoperative hemograms were made.

The clinical pictures of all of these patients were well marked examples of mechanical bowel obstruction, usually of the small bowel. The initial leukocyte count in all except Case VII was not greatly removed from the accepted normal for this condition, ranging from 6,800 white blood cells per cubic millimeter to 14,400. From the first to the fifth postoperative days following the removal of the obstructive lesion, a decisive drop from the total leukocyte count was noted, the extreme low of 1,950 white blood cells being seen in Case II. A similar decrease in the differential polymorphonuclear count to lower levels during the postoperative course of the disease was a common characteristic with a relative leukocytosis and a moderate neutrophilic shift to the left. That a severe myelotoxic reaction was absent is evidenced by the lack of appearance of immature cells such as myelocytes in the stained smears. A few brief summaries of characteristic cases will be presented. Table I shows the complete series.

TYPICAL CASE REPORTS

Case III. A. R., a forty-five year old female, had an appendectomy eleven years prior to entry. A week before admission to the hospital she complained of intermittent pains in the right lower quadrant, eventually presenting a large irregular palpable mass in the lower abdomen which suggested an obstructed small bowel. Flat films showed a bowel obstruction with the obstruction apparently involving multiple loops of small bowel throughout the abdomen. The preoperative white count was not unusual, being 11,750. At operation a large amount of brown fluid escaped on incising the peritoneum and multiple loops of distended blue-black small bowel were found. There was a complete volvulus of the root of the mesentery of the ileum producing a 180 degree twist. At the point of fixation was a thick band extending from the right side of the mesentery to the ileocecal region, probably representing adhesions from the site of the previous appendectomy. A second band was seen on the left connecting the parietal peritoneum and the mesenteric surface of a loop of small bowel. The bands were severed, the volvulus untwisted and the raw surfaces on the small bowel peritonealized. The patient was returned to bed in good condition.

From the preoperative count of 11,750 with 72 per cent polymorphonuclear forms, 24 per cent lymphocytes and a filament-non-filament ratio of 86:14, the count dropped the day following surgery to 2,700 with a differential count of 26:63 and a filament-non-filament ratio of 25:75. The patient maintained a consistent low level between 2,500 and 4,000 until the sixth postoperative day when a return of 5,500 leukocytes with 50 per cent granulocytes,

40 per cent lymphocytes and 50 per cent filamented forms were noted. The leukocyte level remained fairly high for the duration of the remainder of the convalescence and she made an uneventful recovery being discharged on the twenty-fifth postoperative day.

Remarks. This case of severe intestinal obstruction involving the small bowel showed this unusual postoperative leukocyte exhaustion characterized by a marked drop in the leukocytes following correction of the volvulus and the release of all points of obstruction. During this period of time her clinical course was essentially uneventful and in no way alarming. Her recovery was complete.

Case iv. W. M., a twenty-five year old male who had an appendectomy thirteen years previously, entered the hospital complaining of cramp-like abdominal pain, followed by nausea, vomiting, distention and diarrhea of just a few hours' duration. The pain soon localized itself in the right lower quadrant.

Examination of the abdomen showed slight distention and moderate tenderness throughout, with marked pain and tenderness in the right lower quadrant. Percussion note was tympanitic and the patient presented evidence of hypohydration. Temperature 37.5°, pulse 100, respirations 22. Leukocytes totaled 14,500 with 80 per cent polymorphonuclears.

At operation the residue of an old adhesive peritonitis was found. In the right lower quadrant a torsion of the small bowel was discovered and freed with some difficulty. An enteroenterostomy was done about the site of the torsion. The patient's course was complicated only by a transitory gastric dilatation, in the first three days, otherwise his convalescence was uneventful and he made a complete recovery.

On the first postoperative day there was a rise to 23,400 but by the fifth postoperative day the leukocyte count dropped to 5,000 and the following day was recorded at 4,800 with 63 per cent polymorphonuclears, showing a definite shift to the left to 7 filamented cells and 56 nonfilamented forms. On the eighth day after surgery the count had risen to 11,300 with a filament-non-filament tabulation of 26:37, and remained normal until discharge on the sixteenth postoperative day.

Remarks. This case showed an unusual drop of over 18,600 cells in the course of six days to a very low level of 4,800.

Case viii. R. S., a thirty-two year old female, had an appendectomy for subacute appendicitis six months prior to entry to the hospital. Three days before admission the patient noticed some lower abdominal pain, not severe at first, but eventually forcing bed rest; she became nauseated and the pain radiated to the left lower quadrant. On examination there was moderate distention noted over the entire abdomen, and extreme tenderness to pressure was elicited in the left lower quadrant with less tenderness about the old right lower quadrant healed incisional scar. Flat *x*-ray films showed a definite small bowel mechanical obstruction.

At operation 750 cc. of a clear fluid were removed from the peritoneal cavity. The small bowel was dilated and stair-stepped in position. There was a band found coursing between the ascending colon and terminal ileum, and attaching to the mesentery of the terminal ileum causing a constricting obstruction. Two other areas of the ileum were found adherent by adhesive bands to the ileocecal junction. These bands were severed and the patient returned to bed in good condition. Her postoperative course was uneventful; she made a very satisfactory convalescence but the hemograms were of unusual interest. On the first, second and third days after surgery the white count dropped to levels of 5,100 and 3,700; with characteristic changes in the filamented forms. On the fifth postoperative day a rise to 4,400 was noted and on the seventh day it was decided to give the patient 500 cc. of blood to see whether this could effect the hemogram. The patient, however, was doing well. Following the transfusion there was a definite rise in the leukocyte level to essentially normal levels as seen in Table 1.

Remarks. The patient exhibited a moderately advanced mechanical bowel obstruction. Although she had a satisfactory clinical course following the release of her obstruction, the hemogram showed the characteristics of leukopenia which we are describing.

Case x. G. B., age twenty-four, entered Mount Zion Hospital on October 14, 1940. He gave a typical history of lower abdominal pain characteristic of an attack of acute ap-

TABLE I

Case No.	Sex	Age	Diagnosis	Postoperative Day	Leukocytes	Neutrophiles	Lymphocytes	Filamented	Nonfilamented	Results
I. R. S.....	F	47	Intestinal obstruction; carcinoma of colon; postoperative adhesions.	Preoperative	8,500	79	16	..	..	Died
				Fourth	2,600	67	25			
				Fifth	7,600	72	21	15	57	
II. B. N.....	F	37	Intestinal obstruction; ruptured ectopic pregnancy.	Preoperative	14,400	84	16	..	..	Died
				First	13,100	93	7			
				Third	1,950	65	32			
				Third	2,550	67	26			
				Fifth	4,300	44	45			
III. A. R.....	F	45	Intestinal obstruction; volvulus; adhesions.	Preoperative	11,750	72	24	86	14	Recovered
				First	2,700	63	26	25	75	
				Second	3,625	66	30	14	86	
				Third	2,500	70	27	32	68	
				Fourth	2,750	70	20	43	57	
				Fifth	5,100	56	40	50	50	
				Sixth	8,900	79	18	46	54	
				Seventh to twenty-fifth	Over 12,500					
IV. W. M.....	M	25	Intestinal obstruction; postoperative adhesions.	Preoperative	14,500	82	18	..	..	Recovered
				First	23,400	85	7			
				Third	10,000	74	21			
				Fifth	5,000	63	24	11	52	
				Sixth	4,800	63	22	7	56	
				Seventh	7,500	65	20	16	48	
				Eighth	11,300	63	26	26	57	
				Ninth to sixteenth	Over 12,500					
V. A. G.....	F	32	Intestinal obstruction; internal hernia.	Preoperative	10,000	79	15	70	30	Recovered
				First	12,200	65	33	50	50	
				Second	10,300	87	13	51	49	
				Third	5,850	56	39	26	74	
				Fourth	4,550	59	38	53	47	
				Fifth to thirtieth	Over 9,000					
VI. L. G.....	M	59	Intestinal obstruction; carcinoma of prostate.	Preoperative	6,800	70	18	..	..	Died
				Second	3,300	38	56	5	95	
				Third	3,800	42	53	8	92	
				Fifth	4,280	53	24	8	92	
VII. C. T.....	M	70	Intestinal obstruction; fibrous band.	Preoperative	3,400	85	15	30	70	Died
				First	4,000	70	26	60	40	
				Second	3,700	63	33	40	60	
				Third	4,525	62	33	40	60	
				Fourth	4,550	77	19	50	50	
				Fifth	8,900	76	20	45	31	
				Sixth	14,000	82	14	36	46	
				Seventh	8,500	79	17	59	41	
				Eighth	8,750	78	18	44	56	
				Ninth	8,950	75	21	46	54	
				Tenth	6,000	76	20	27	73	
				Eleventh	4,600	84	12	65	35	
				Twelfth	8,200	90	8	68	32	
				Thirteenth	8,200	82	14	58	42	
VIII. R. S.....	F	32	Intestinal obstruction; postoperative adhesions.	Preoperative	11,800	65	34	69	31	Recovered
				First	5,100	76	20	36	64	
				Second	4,050	68	24	50	50	
				Third	3,700	66	29	30	70	
				Fifth	4,400	67	30	20	80	
				Seventh	7,150	68	30	56	44	
				Tenth	8,250	58	38	80	20	
IX. A. H.....	F	24	Intestinal obstruction; postoperative adhesions	Preoperative	2,600	54	46	..	..	Recovered
				First	5,900	50	49			
				Fourth	6,400	60	40			
				Twenty-first	4,100	40	47			
X. G. B.....	M	23	Intestinal obstruction. appendiceal abscess	Preoperative	15,000	91	8	73	27	Recovered
				Second	6,600	86	14	57	43	
				Third	4,100	86	13	59	41	
				Fourth	3,800	75	24	66	34	
				Fifth	3,500	86	12	46	54	
				Sixth	5,100	80	16	60	40	
				Eighth	4,550	84	15	65	35	
				Ninth	4,800	88	10	57	43	
				Tenth	6,950	82	18	30	70	
				Eleventh	8,050	88	10	55	45	
				Thirty-first	21,000	73	6	39	61	
				Forty-first	7,500	60	36	67	33	

pendicitis of a weeks' duration. He had taken purgatives.

Examination on admission to the hospital showed a board-like rigidity of the abdomen, temperature, 103°F., leukocyte count 15,000, and 91 per cent polymorphonuclears. A preoperative diagnosis of a perforated appendix was made with probable abscess formation.

At operation there was found a completely perforated appendix which was enclosed in the omentum and contained a large abscess. There was a moderate amount of peritonitic reaction between the loops of the small bowel but the picture was more that of a local peritonitis, rather than that of a spreading peritonitis. The patient was returned to bed in good condition.

On the second day postoperatively, the white count dropped to 6,600 with 86 per cent polymorphonuclears but nothing was particularly thought of this count at the time as the patient generally was doing well. His abdomen was not distended and he was passing small amounts of gas. However, on the third postoperative day his white count was down to 4,100 with 86 per cent polymorphonuclears and it was thought advisable to order a flat plate of his abdomen. He was not nauseated, nor had he vomited. The flat plate showed a definite small bowel obstruction in the ileocecal region with multiple dilated loops of small bowel. A Miller-Abbot tube was passed on this patient and after eight days of treatment with the Miller-Abbot tube, a check-up *x*-ray showed complete disappearance of the small bowel obstruction. The blood count as seen from the chart showed a moderate leukopenia during this period of time and by the time the patient had recovered from evidence of his bowel obstruction on the eleventh day his blood count was up to an essentially normal white count. It is of interest to note that on the thirty-first day postoperatively, the patient developed a temperature and a leukocytosis when evidence was found of a cul-de-sac abscess which was incised and drained through the rectum.

Remarks. This case illustrates the possible diagnostic value of this leukocyte exhaustion picture. Its appearance on the third and fourth postoperative days with no other evidence of bowel obstruction nor any evidence of a spreading peritonitis, suggested the possibility that he might have a partial small bowel obstruction so that flat plates of his abdomen were ordered which definitely showed a mechanical obstruction of his small bowel. Treatment with the Miller-Abbot tube relieved this completely. It is also of interest to note that his leukocytic exhaustion was not a permanent condition as the patient was able to develop a real leukocytosis when he developed the late complication of a cul-de-sac abscess.

The entire series of ten cases is shown in detail in Table 1, the details of the monocyte, eosinophiles and basophilic tabulation have been omitted as there was nothing of unusual note detected.

DISCUSSION

That a definite lethal toxin is produced in a loop of obstructed small bowel is today a generally accepted fact. It is our belief that the preoperative distention of the obstructed loops compress the capillary circulation so that absorption from the obstructed loops of the toxin is minimal. The operative release of the obstructed loops apparently permits of drainage into better functioning loops of bowel and more rapid systemic absorption in the immediate postoperative period. This thesis would explain the leukocytic exhaustion seen in the postoperative period. An occasional case in which the leukopenia is noted preoperatively can be explained on the basis of an incomplete obstruction allowing some drainage from the partially obstructed loops into the nonobstructed loops, thereby permitting a certain amount of absorption of this toxin which has a depressing effect on the bone marrow.

We believe that the production of leukopenia as has herein been noted is part of the reaction of the patient to the sudden release of the toxic products. Peculiarly a definite paralysis of the bone marrow ensues so that the normal leukocytes are prevented from entering the peripheral circulation simply by repression of leukopoiesis. That a marrow reaction of this type is encountered is evidenced

not only by the leukocytic drop but also by a shift to the left in the filament-non-filament ratio. That the myeloid response is not too severe is demonstrated by there being no outpouring of any myelocytes or other immature forms in the primitive leukocytic series.

The paresis of the bone marrow by this or these toxins of intestinal obstruction following their release systemically may be moderately severe, however, as shown by the low point of the leukopenia, to wit, 1,950 white blood cells on the third postoperative day in Case II. Yet the severity of the reaction is not necessarily indicative of a fatal prognosis. The fact that this change in the hemogram appears immediately postoperatively and persists for a few days does not infer that a fatality will result, as a majority of the patients survived. Furthermore, they survived without coursing through a stormy postoperative period. These patients were not acutely ill, and at no time demonstrated any additional morbidity over the usual accompaniments of the disease when corrected surgically. The four deaths in the series resulted from the primary lesion in each specific case and not from the "leukocyte exhaustion."

The phrase, "leukocyte exhaustion," has been aptly applied by Van Duyn[9] to that state of the white cells existing in a progressive down-hill course following operation. Van Duyn found a leukopenia associated with a normal differential count and a marked shift to the left of the neutrophiles. This type of hemogram is indicative, he believes, of a marked strain on the leukopoietic powers of the patient, and in some instances where a leukopenic state exists prior to surgery, that it infers a "low leukocyte reserve."

Such a point was noted in Case VI, where preoperatively the patient presented a total leukocyte count of 3,400 with 85 per cent polymorphonuclears and a filament-non-filament ratio of 30:70. It is difficult to imagine a change in the patient's myeloid status in the short period prior to the onset of this condition, sufficient to cause such a diminution of leukocytes. It is believed, preferably, that a partial obstruction must exist, without complete occlusion, permitting partial absorption of the toxin of obstruction into the general circulation, producing a lowered leukocyte level prior to a total release of the intestinal block by surgical means.

The demands made on the bone marrow at this time of need are great, and this is evidenced by the marked proliferation of young forms or nonfilamented polymorphonuclears seen in the shift to the left of that count. The toxic reaction of the marrow is not sufficiently severe as to cause the delivery of damaged leukocytes with unusual morphology. All the leukocytes seen were normal forms but few in number. Van Duyn did note this "leukopoietic breakdown" in two cases in which paralytic type of abdominal distention was present.

The present series of cases presenting leukopenia were not complicated by severe state of sepsis such as those cases described by Van Duyn and other writers in which the leukopenia indicate usually a fatal prognosis. In this series the postoperative course appears to be uninfluenced by the changes in the blood count and the majority of patients recovered without any clinical evidence of severe toxemia. No attempt was made in the present series to influence by some form of specific therapy the leukocyte count.

Therapy of such a condition as postoperative leukopenia has been attempted, particularly by Richmond,[10] who discussed a patient with an apparently normal leukocyte reserve who in the course of an abdominal infection developed a severe leukopenia with an associated drop in the granulocytes. As myelopoiesis is stimulated by the nucleotides, replacement therapy was attempted by Richmond in this case in which the normal stimulus had been damaged. A substance prepared by hydrolysis of yeast nuclei, called adenine sulfate, was given and effected myeloblastic activity favorably.

One questions the need of any specific therapy in view of the short duration of the lowered granulocytic state and the eventual excellent recovery in most of the cases. No specific therapy seems indicated as the leukopenia is only a symptom. The toxin of intestinal obstruction must be treated rather than the leukopenia.

The status of the leukocyte picture in intestinal obstruction can be determined very easily and any change in the white cell reserve anticipated through frequent and careful blood determinations done throughout the course of the disease. Daily counts of the total number of white cells and the making of differential smears are urged in order to establish the etiology of any unusual event in the patient's postoperative course in the treatment of intestinal obstruction. By so doing, it is hoped that some light may be shed on the nature of the toxin or substance responsible for the toxemia of bowel obstruction. The exact status of the myelotoxic reaction or myeloid hypoplasia was not known in our cases but could probably easily be determined by bone marrow biopsies. It is our hope that in the future an opportunity will present itself to perform some bone marrow biopsies on these postoperative intestinal obstruction cases.

SUMMARY

1. The occurrence of leukopenia in the immediate postoperative period following the release of intestinal obstruction and unrelated to any surgical sepsis is reported for the first time.

2. This leukopenia does not necessarily indicate a fatal prognosis or a severe postoperative course.

3. The mechanism of such a leukopenia is explained on the basis of the systemic absorption of the toxin of intestinal obstruction producing a temporary bone marrow paresis.

4. It is believed such a leukopenia is not a rarity and will be found frequently if routine blood counts are taken daily in the immediate postoperative period of cases of operative intestinal obstruction.

5. The presence of leukopenia of this type may occasionally give diagnostic value in early incomplete small bowel obstruction.

6. Treatment should be directed at the elimination of the toxin of intestinal obstruction rather than specific therapy to raise the leukocytic level.

REFERENCES

1. Wangensteen, O. H. The Therapeutic Problem in Bowel Obstruction. Pp. 48 and 109. Baltimore, 1937. Chas. C. Thomas.
2. Vidgoff, I. J. Acute intestinal obstruction. *Am. J. Surg.*, 95: 801, 1932.
3. Russel, R. D. Acute intestinal obstruction. *J. Kansas M. Soc.*, 31: 351.
4. Watson, C. H. and Sargeant, T. R. Significance of low leukocyte count in acute pyogenic infections. *Canad. M. A. J.*, 39: 460, 1938.
5. Cornell, N. W. Acute intestinal obstruction at the New York Hospital. *Am. J. Surg.*, 95: 810, 1932.
6. Rentschler, C. B. Acute intestinal obstruction. *Arch. Surg.*, 29: 828, 1934.
7. Workman, E. W. and Miller, G. G. A clinical review of two hundred and forty-one cases of obstruction of the small bowel. *Canad. M. A. J.*, 30: 141, 1934.
8. Fey, A. and Cubbins, W. R. Acute mechanical intestinal obstruction: mortality with and without enterostomies. *Surg., Gynec. & Obst.*, 60: 738, 1935.
9. Van Duyn 2nd, J. Leukocyte exhaustion following surgical procedures. *Arch. Surg.*, 37: 302, 1938.
10. Richmond, E. L. Granulocytopenia following surgical sepsis and treated with adenine sulphate. *New England J. M.*, 221: 267, 1939.

MALIGNANT ARGENTAFFINE TUMORS OF THE APPENDIX*

EARL O. LATIMER, M.D.
Attending Surgeon, Wesley Memorial Hospital
CHICAGO, ILLINOIS

ARGENTAFFINE tumors of the gastrointestinal tract are becoming of increasing interest because of the number that are found to be malignant. While malignancy among argentaffine tumors of the appendix is extremely rare, it does occur, and every argentaffine tumor is potentially malignant.

Merling[1] (1838) is generally supposed to be the first to describe a tumor of the appendix; Sellinger,[2] however, is of the opinion that a true tumor of this organ was not described until 1882 when Berger reported his case.

All tumors of the appendix prior to 1907 were called carcinomas. In that year Oberndorfer[3] described a group of tumors peculiar to the gastrointestinal tract and most common in the appendix. He concluded that these tumors were always benign, were slow of growth and were harmless. Oberndorfer called these tumors "carcinoids" because of their histologic resemblance to carcinomas. He stated that these "carcinoid" tumors are located in the submucosa, may invade the mucosa, but the muscularis and mucosa are always intact. He was the first to note the chromaffin nature of the tumor cells but did not establish the origin of the parent cells.

Several theories of origin of the tumor cells were advanced. Bunting[4] considered them analogous to Krompecher's basal cell carcinoma of the skin. Trappe[5] believed the so-called "carcinoids" and adenomyomas of the bowel arose from pancreatic rests which are fairly common in the gastrointestinal tract. Tonniessen[6] was of the opinion that they originated from epithelial rests in the gastrointestinal tract.

In 1897, Kultschitzky[7] described a peculiar cell in the mucosa of the gastrointestinal tract. This cell was most common in the appendix and was of decreasing frequency as the distance from the appendix increased. It was extremely rare in the colon. Schmidt[8] (1905) observed the chromaffin characteristics of certain cells of the bowel mucosa and suggested the possibility of these being the same type of cells described by Kultschitzky. Huebschmann[9] (1910) advanced the theory that these chromaffin cells gave rise to the "carcinoid" tumor of the gastrointestinal tract. It remained for Gosset and Masson[10] to demonstrate the silver staining granules in these tumor cells, whence the name "argentaffine" or "chromargentaffine" tumors. Lewis and Geschicter[11] classified these tumors as paragangliomas, supporting the work of Masson.[12]

As to the frequency of the argentaffine tumors of the appendix, Elting,[1] in 1903, could find only twenty three cases. Jackson[13] collected 317 cases from the literature up to 1923, which number was increased to 322 cases by 1934. To date over 400 cases have been reported. It is probably true that many more cases are not reported than reported, since 0.2 to 0.5 per cent of all appendices removed at operation contain argentaffine tumors.

CLINICAL FINDINGS

Argentaffine tumors of the gastrointestinal tract as a rule do not produce symptoms unless obstruction of the bowel lumen occurs. A few have metastasized to the regional mesenteric lymph-nodes and liver, giving symptoms characteristic of other malignancies of the gastrointestinal tract. On the other hand argentaffine tumors of the appendix are frequently discovered earlier not because of any characteristic

* From the Division of Surgery, Northwestern University Medical School and Wesley Memorial Hospital, Chicago.

symptoms but because of symptoms referable to the appendix. The symptoms are usually those attributed to so-called chronic appendicitis, the most frequent symptom being dull pain in the right lower abdominal quadrant. The symptoms may be more acute with sharp pain, nausea and vomiting—the neurogenic appendix of Masson.[14] Acute appendicitis may be superimposed giving rise to symptoms of acute inflammatory process.

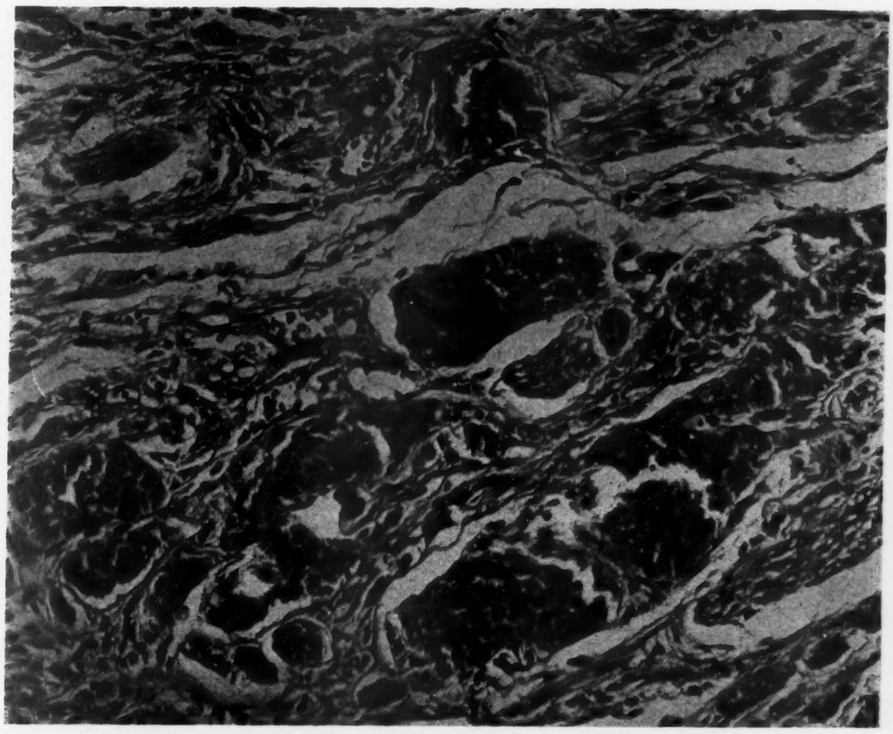


Fig. 1. Photomicrograph of Case 1 showing large groups of tumor cells in the muscle layer of the appendix extending to the serosa.

GROSS PATHOLOGY

Argentaffine tumors of the appendix are usually located in the distal third of the organ. It is a nodule in the submucosa. While the lumen appears to be obliterated, the mucosa, in reality, is lifted up and is pressed against the mucosa of the opposite wall. The lesion averages from 0.5 to 1.0 cm. in diameter but in rare instances is large enough to be palpated through the intact abdominal wall. The serosa of the appendix is, as a rule, normal. The tumor may be yellow in color and its cut surface is bright yellow. Sometimes there are multiple tumors.

On rare occasions the tumor metastasizes into the regional lymph-nodes, and distant metastasis may occur in the liver. The tumor may invade the mesoappendix by direct extension. Bailey[15] states that the metastases occur characteristically outside the lymph-nodes and smaller groups of actively proliferating cells invade the nodes. Raiford[16] believes the metastatic cells enter the lymph-nodes by way of the lymphatics causing a profuse fibrosis which destroys and replaces the lymphoid tissue.

MICROSCOPIC PATHOLOGY

Raiford[16] has given an excellent description of the microscopic anatomy of the argentaffine tumors. The tumor cell nests are usually separated by dense connective tissue but may be packed closely together. A false capsule is formed by the smooth muscle fibers of the bowel wall. These muscle fibers are frequently invaded by tumor cells. The cells have distinct nuclei but the

cytoplasm is indistinct. Smaller cell groups may be arranged in rosettes. The cells are columnar in shape, have distinct cell borders and resemble neuroblastomas. The cells contain silver staining granules which are easily demonstrated by proper staining technic. Bailey[15] found elastic tissue in great abundance in these tumors, whether benign or malignant. Mitotic figures while present are not abundant. The histologic picture is characteristic but if doubt exists silver stains will confirm the diagnosis.

FIG. 2. Photomicrograph of Case 11 showing large tumor masses in the muscle wall. Note the difference in staining quality of the tumor cells in certain groups.

MALIGNANCY

While metastases are not the rule they do occur. The tumor may invade adjacent tissues by direct extension. Lewis and Geschicter[11] state that 20 per cent of the argentaffine tumors become malignant. Malignancy of argentaffine tumors of the appendix is less frequent.

The difficulty in determining the incidence of malignant lesions is due in part to the hesitancy of some pathologists to call an argentaffine tumor malignant unless the regional lymph-nodes or the liver are invaded. Some authors do not classify argentaffine tumors malignant when they have invaded the mesoappendix but have not extended to the regional lymph-nodes. Raiford[16] considers the degree of malignancy to increase as the distance of the lesion from the appendix increases.

That argentaffine tumors of the appendix are less often malignant than similar lesions located elsewhere in the gastrointestinal tract is due to the earlier removal because of positive symptoms necessitating surgical intervention. Bailey[15] collected seven cases of malignancy of argentaffine tumors of the appendix from the literature. He considered malignant a similar lesion of

the ileum that had extended into the adjacent mesentery, while Forbus[17] did not consider as malignant two tumors of the appendix that had extended into the mesentery. The total number of malignant carcinoids of the appendix reported in the literature is fourteen.[18,19] Three new cases are added in the present report. The total number of malignant argentaffinomas of the entire gastrointestinal tract and gallbladder reported amounts to seventy-three.

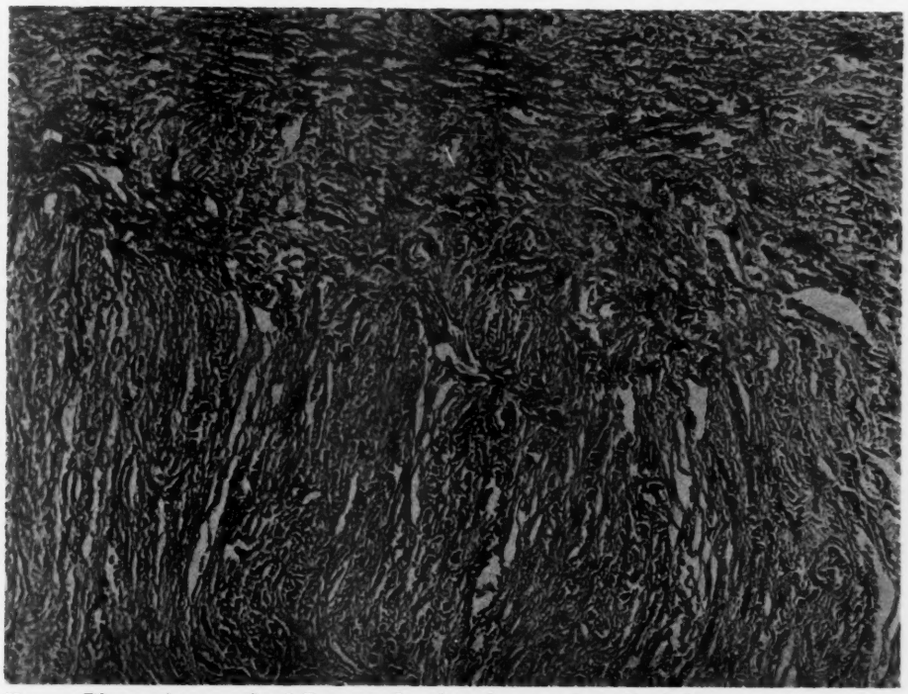


Fig. 3. Photomicrograph of Case III showing the muscle wall of the appendix invaded by tumor cells. Note the cord-like arrangement of the cells in the lower half of the picture.

It is generally agreed that all argentaffine tumors are potentially malignant. However, most of them are of low grade malignancy and require a long time to metastasize. They will break through the bowel structure and infiltrate the adjacent mesentery or may become implanted as "kissing" metastases. From this local invasion the tumor cells may metastasize to the lymph-nodes or beyond.

Even the metastatic cells may be of a very slow and relatively benign type as illustrated by a case reported by Mallory[20] from the Massachusetts General Hospital. The patient had a resection of a portion of the ileum because of an argentaffine tumor. He died fifteen years later of an entirely unrelated condition. At the postmortem examination a retroperitoneal lymph-node was found that contained argentaffine tumor cells. The metastasis had occurred at least fifteen years before death but had not spread beyond that single retroperitoneal lymph-node.

The author has recently removed two argentaffine tumors of the appendix which he considered malignant. One extended into the adjacent mesoappendix, the other was attached to the brim of the pelvis where the appendix was lying adjacent to this structure. A third case is briefly reported here. This latter case is to be reported in detail later.[21]

CASE REPORTS

Case I. A white male, thirty-eight years of age, presented himself on July 31, 1938, because of acute colicky abdominal pains of seventeen hours' duration. The history was suggestive of acute appendicitis but there was no nausea, vomiting or change of bowel habit.

The patient was well developed and well nourished. His temperature by mouth was 100.6°F. There was tenderness on pressure and slight protective rigidity in the right lower quadrant of the abdomen. Marked rebound tenderness was present in this area. Rovsing's sign was positive. The erythrocyte count was 5,170,000, hemoglobin 16.7 Gm. (99 per cent Newcomer). The white blood count was 11,600 with 86 per cent polymorphonuclear neutrophils. An acutely inflamed appendix was removed through a muscle splitting incision.

The pathologist's macroscopic report was as follows: The appendix measured 8 by ¾ to 1¼ cm. The serosa was dull and hyperemic in the distal half. The distal one-fourth of the appendix was markedly distended. In this portion of the lumen there was a very hard fecalith. Distal to the fecalith the wall of the appendix was very thick and edematous. Portions of this wall appeared to be necrotic.

Microscopically, the portion of the appendix wall which appeared to be thickened by fibrosis was infiltrated by tumor tissue. Within the lumen of the appendix were groups of rounded or oval cells which were not very large or chromatic. These groups of cells were separated by narrow strands of connective tissue. The individual cells were uniform in size and mitotic figures were quite rare. There was a gradual transition from the above described cells to cells of the same size but which were more chromatic, growing in narrow spindle-shaped groups, invading the muscle wall and the mesoappendix. Mitotic figures were more numerous among these cells. There was necrosis of the appendiceal mucosa adjacent to the tumor tissue and the lumen was filled with necrotic tissue and pus cells. At one point there was necrosis of the tumor tissue.

Diagnosis: Acute appendicitis superimposed on a malignant argentaffine tumor of the appendix.

This patient is still well after removal of the iesion. Frequent examinations have not revealed any evidence of recurrence, even though it was not certain that all of the tumor tissue was removed from the mesoappendix.

Case II. An apathetic white male, twenty-one years of age, was admitted to the Wesley Memorial Hospital May 22, 1939. His complaints were nausea and fullness in the epigastrium after meals for a duration of two years. For the past four years he had had repeated attacks of acute abdominal pains with fever, nausea and vomiting that had been diagnosed by his family physician as acute appendicitis. The last such attack was five weeks previous to admission to the hospital. Several gastrointestinal studies had failed to reveal any abdominal pathological condition. Because of self-imposed dietary regulations, the patient had lost over forty pounds. The blood and urine findings were within normal limits.

At the time of the operation the stomach and duodenum were found normal. The gallbladder was covered with omentum which was lightly attached by fibrous adhesions. The gallbladder wall was thin and blue and the gallbladder was easily emptied by pressure. The appendix was normal in the proximal two-thirds but the distal third was enlarged, thickened and firmly attached to the brim of the pelvis by granulation tissue and fibrous tissue. The appendix was freed with difficulty and removed. There were no enlarged regional lymph-nodes either in the mesoappendix or mesentery of the terminal ileum.

The pathological report was as follows: The appendix was 7 by 0.75 cm. The wall was fairly uniform in thickness except in the distal 1 cm. The tip was thickened and sections made by cutting were slightly yellow in color.

Microscopically, sections through the thickened distal portion of the appendix showed replacement of most of the submucosa by groups of tumor cells. The tumor cells were fairly uniform in size and shape and were not very chromatic although the cells contained more than the usual amount of chromatin that is found in the strictly benign carcinoid. The groups of cells varied much in size and could be found in all layers of the wall including the serosa. Hyperemic granulation tissue was present about the groups of tumor cells and a moderate small round cell infiltration was present in all layers of the wall of the distal portion of the appendix. A few mitotic figures were present. The mesoappendix did not contain tumor cells. The invasion of the wall with scattered small groups of cells which were slightly more chromatic than normal for carcinoids strongly suggested malignancy.

Diagnosis: Malignant argentaffine tumor of the vermiform appendix.

Discussion of Case II. Since the serosa was invaded by tumor cells at a point

corresponding to the attachment of the tip of the appendix to the pelvic brim, one must conclude that tumor cells were implanted in the peritoneum at this point of attachment.

One year after operation a thorough gastrointestinal examination failed to demonstrate any lesion of the bowel. As a prophylactic measure high voltage deep *x*-ray therapy has been used on this patient.

Case III. This patient was operated upon by Doctor R. N. Bills and the specimen was examined by Doctor E. R. Strauser, of the Wesley Memorial Hospital and is reported here through their courtesy. A white woman (Mrs. F. B.), sixty-three years of age, was admitted to the Methodist Hospital, Gary, Indiana, because of acute symptoms referable to the right lower abdominal quadrant. There was marked tenderness and rebound tenderness over McBurney's point. The erythrocyte count was 5,230,000, hemoglobin 13.4 Gm. (92 per cent), white blood count 20,300 with 90 per cent polymorphnuclear leukocytes. At operation, November 3, 1939, a fibrotic appendix was removed.

The gross pathology revealed the appendix to be 6 by ¾ to ¼ cm. with an irregularly thickened wall. The wall was fibrotic, especially the distal portion. The distal portion of the lumen was obliterated.

Microscopically, the lumen of the distal portion of the appendix was completely obliterated by tumor growth which was composed of small alveolar and tubular units. There were no sharp cytoplasmic limits of the tumor cells but apparently the cells were of the low columnar or cuboidal type. Only a few of the tubular or alveolar structures had lumen. This may be due to the fact that they were filled with material with staining properties similar to the cytoplasm. The tumor cells were only moderately chromatic but some had distinct nucleoli and there were a few mitotic figures. Extending through the muscle wall and serosa were small spindle-shaped groups of deeply stained cells which tended to split muscle bundles and in places were associated with the same type of cell as those in the lumen. This growth in the muscle wall and serosa had very much the appearance of a scirrhous carcinoma with the muscle tissue taking the place of fibrous stroma. Only a small segment of muscle wall was without this tumor tissue. Tumor cells had invaded the mesoappendix.

Diagnosis: Malignant argentaffine tumor of the appendix.

MANAGEMENT OF ARGENTAFFINE TUMORS

Whether benign or malignant, argentaffine tumors should be surgically excised. These tumors when located in the stomach or bowel should be excised along with adjacent bowel and mesentery. If metastases to regional lymph-nodes are present, these should be removed if possible.

Simple appendectomy will suffice in almost all cases of argentaffine tumors of this organ. In fact the diagnosis usually is not made until the microscopic examination is made. In cases in which a nodule is felt in the wall of the appendix, the organ should be cut through in this area; and if yellow tissue is present, the mesoappendix and mesentery of the terminal ileum should be closely searched for visible or palpable lymph-nodes. If any are found, they should be removed. Also if the diagnosis of argentaffine tumor is made during the course of an appendectomy, a liberal portion of the mesoappendix should be removed if possible.

Leaving an involved lymph-node is not necessarily fatal as illustrated by Mallory's case,[20] yet incomplete removal of malignant lesions or metastases may be responsible for recurrence.

CONCLUSIONS

1. Carcinoid or argentaffine tumors of the gastrointestinal tract originate from argentaffine cells described by Kultschitzky.[7] These cells are believed to be related to the chromaffin system.

2. Argentaffine tumors occur most often in the appendix but may occur in the stomach, small bowel, Meckel's diverticulum, colon and gallbladder.

3. Argentaffine tumors are present in 0.2 to 0.5 per cent of all appendices removed surgically.

4. While the lesion is most frequent in the appendix only seventeen of the seventy-

six malignant argentaffine tumors, including three cases here reported, occurred in the appendix.

5. Argentaffine tumors of the appendix are less frequently malignant because they produce clinical symptoms and are removed earlier than similar lesions elsewhere in the gastrointestinal tract. All argentaffine tumors are potentially malignant.

6. Three new cases of malignant argentaffine tumors of the appendix are reported.

7. Surgical removal is the treatment of choice of all argentaffine tumors.

REFERENCES

1. Quoted by Elting. Primary carcinoma of vermiform appendix. *Ann. Surg.*, 37: 549, 1903.
2. Selinger, J. Primary carcinoma of vermiform appendix. *Ann. Surg.*, 89: 276, 1929.
3. Oberndorfer, S. Karzinoide Tumoren des Dünndarms. *Frankfurt. Ztschr. f. Path.*, 1: 426, 1907.
4. Bunting, C. H. Multiple primary carcinoma of the ileum. *Bull. Johns Hopkins Hosp.*, 15: 389, 1904.
5. Trappe, M. Ueber Geschwulstartige Fehlbildungen Von Niere, Milz Haset und Darm. *Frankf. Ztschr. f. Path.*, 1: 109, 1907.
6. Toenniessen, E. Untersuchungen ueber die in der Submucosa des Dünndarms Vorkommenden Epitheliolen Tumoren. *Ztschr. f. Krebsforsch.*, 8: 355, 1910.
7. Kultschitzky, N. Zur Frage Üeber den Bau des Darmkanals. *Arch. f. mikr. Anat.*, 49: 7, 1897.
8. Schmidt, J. E. Beiträge zur Normalen und Pathologischen Histologie einiger Zellarten der Schleimhaut des Meschlichen Darmkanales. *Arch. f. mikr. Anat.*, 36: 12, 1905.
9. Hüebschmann, P. Sur le carcinome primitif de l'appendice vermiculaire. *Rev. méd de la Suisse Rom.*, 30: 317, 1910.
10. Gosset, A. and Masson, P. Tumers endocrines de l'appendice. *Presse méd.*, 22: 237, 1914.
11. Lewis, D. and Geschicter, C. F. Tumors of the sympathetic nervous system. *Arch. Surg.*, 28: 16, 1934.
12. Masson, P. Contributions to the study of the sympathetic nerves of the appendix. The musculonervous complex of the submucosa. *Am. J. Path.*, 6: 217, 1930.
13. Jackson, A. S. Carcinoma of the appendix. *Arch. Surg.*, 6: 653, 1923.
14. Masson, P. Les lésions nerveuses de l'appendicite chronique. *Compt. rend. Acad. d. Sc.*, 173: 262, 1921.
15. Bailey, O. T. Argentaffinomas of the gastrointestinal tract, benign and malignant. *Arch. Path.*, 18: 843, 1934.
16. Raiford, T. S. Carcinoid tumors of the gastrointestinal tract. *Am. J. Cancer*, 18: 803, 1933.
17. *Forbus*, W. D. Argentaffine tumors of the appendix and small intestine. *Bull. Johns Hopkins Hosp.*, 37: 130, 1925.
18. Wyatt, Thomas E. Argentaffine tumors of the gastrointestinal tract. *Ann. Surg.*, 107: 260, 1938.
19. Porter, Joseph E. and Whelan, Charles S. Argentaffine tumors. *Am. J. Cancer*, 36: 343, 1939.
20. Mallory, T. B. Carcinoid of appendix with retroperitoneal metastases. *New England J. Med.*, 215: 1176, 1936.

STATISTICAL REVIEW OF CARCINOMA OF THE STOMACH

GEORGE M. SAYPOL, M.D. AND J. WILLIAM HINTON, M.D.
NEW YORK, NEW YORK

LIVINGSTON and Pack[3] have made an exhaustive study of the end results in the treatment of gastric cancer. While the outlook in recent years has been encouraging when statistics are considered from some of the large clinics, there are still numerous reports from well established clinics which portray a dismal picture. We hope to clarify in this review the reason for the difference in these reports.

Illustrative of the latter was a review of 444 cases of gastric cancer at the Fourth Division of Bellevue Hospital, presented by Abrahamson and Hinton.[1] While there was no follow-up, sufficient information was obtained to indicate a gloomy prognosis for the class of patients which seeks medical aid in a Municipal hospital. It was pointed out that the matter of selectivity played a very important part in determining operability and resectability of gastric cancer cases. Therefore, for comparative purposes, a study of cancer of the stomach from the years 1920 to 1939 inclusive, was undertaken at the New York Post-Graduate Hospital. In order to eliminate the factor of "extra selection" of cases, all patients from an attendant's office were eliminated and only clinic cases admitted to the medical or surgical wards were included. Selectivity here played a part in that many of the patients were referred to the clinic by general practitioners, and their economic status was necessarily above that of the person who attends a free clinic. A discussion of the follow-up was not intended, merely a statistical study to determine operability and resectability.

There were 202 cases proved by *x*-ray, operation or both. Of the 202 cases there were six in which operation was advised but not done, the reason not having been determined. These cases were excluded, leaving 196 cases for study.

OPERABILITY AND MORTALITY

One-fourth, or forty-five cases were inoperable, ten being so for more than one reason. Of these seven patients died, the mortality being 15.5 per cent. (Tables I and II.) At Bellevue Hospital two-thirds were inoperable on admission and among these there was a mortality of 51.7 per cent.

TABLE I
INOPERABILITY

Reason for Inoperability	Number	Unimproved	Died
Clinical			
Moribund	2	..	2
Risk	8	6	2
Metastases	10	8	2
By *x*-ray			
Extensive lesion or metastasis	19	18	1
Refused	16	16	

TABLE II
OPERABILITY AND MORTALITY

Operability	Number	Deaths	Mortality, Per Cent
Operable	151	53	35.1
Inoperable	45	7	15.5
Total	196	60	30.6

Three-fourths, or 151 cases were operable, there being among these fifty-three exploratory laparotomies, forty-eight palliative operations, and fifty resections. (Table II and III.) The mortality in the operable cases was 35.1 per cent as compared with a mortality at Bellevue of 52.0 per cent, among 148 operable cases.

The resectable cases comprised 25.5 per cent of the total and 33.1 per cent of the operable cases, as compared with 5.4 per cent of the total and 16.2 per cent of the

operable cases at Bellevue. Stated another way, a case admitted to Post-Graduate Hospital with a diagnosis of cancer of the stomach had one chance in four for resectability. If operable his chances were one in three.

TABLE III
OPERATIONS

Procedure	Number	Improved	Unimproved	Died
Exploratory	53	..	43	10
Palliative	48	27	..	21
Resection	50	28	..	22
Total	151	55	43	53

The mortality in our resectable cases was 44 per cent, at Bellevue it was 54.2 per cent.

TABLE IV
RESULTS OF PALLIATIVE OPERATION

Procedure	Number	Improved	Died
Gastrostomy	5	2	3
Jejunostomy	5	4	1
Gastroenterostomy	38	21	17
Total	48	27	21

Palliative operations are listed in Table IV. All those who survived their operation and left the hospital were classed as improved, though one might well question the meaning of the word "improved" in gastric cancer which is found to be resectable.

DIAGNOSIS

Age and Sex. There were 145 males and fifty-seven females, a ratio of about three to one; the majority occurred between the ages of forty-one and seventy. There were twenty-nine cases between the ages of twenty and forty years.

Symptomatology. While pain, weight loss, nausea and vomiting were most commonly presenting symptoms, they differed somewhat from those at Bellevue. In the latter series, nausea and vomiting were not as common, while other more advanced signs such as weakness, cachexia and jaundice were found much more frequently. Anorexia, considered usually as a common early symptom, was a complaint in 31.7 per cent of our cases. What constituted the true early symptoms and found uniformly predating the tabulated findings, were increasing heartburn, epigastric "distress," eructations, and other similar vague complaints. A mass considered often a hopeless sign, was felt in forty-three cases. (Table v.)

TABLE V
PRESENTING SYMPTOMS AND SIGNS IN ORDER OF FREQUENCY

Symptoms and Signs	Number	Percentage
Pain	154	76.2
Loss of weight	145	71.8
Nausea or vomiting	121	59.9
Anorexia	64	31.7
Weakness	55	27.2
Cachexia	45	22.3
Mass	43	21.3
Jaundice	7	3.5
Hematemesis	7	3.5

Duration of Symptoms. There was no direct relationship between duration of complaints and operability or resectability. There was a higher percentage of resectable cases in the group having symptoms for six months to three years than the group having symptoms for one to six months. (Table VI.) This finding was also present in the Bellevue series and is probably related to type and grade of gastric cancer.

Relation to Peptic Ulcer. In our series there were twelve cases in which co-existing ulcer and tumor were diagnosed by *x*-ray, while eight cases gave a past history of perforation, hemorrhage, or previous roentgenological diagnosis of ulcer. What is more interesting was an unqualified pathological diagnosis in five cases of "carcinoma following ulcer." The latter condition has been discussed by many

others[2,4] and its authenticity is at best, difficult to prove.

Table VI
RELATION OF OPERABILITY AND RESECTABILITY TO DURATION OF SYMPTOMS

Duration	Number	Non-operable	Operable	Resection
Less than 1 month	11	4	5	2
1 to 3 months	33	4	22	7
3 to 6 months	48	17	24	7
6 to 12 months	48	11	25	12
1 to 2 years	24	5	9	10
2 to 3 years	12	2	5	5
3 to 5 years	6	1	2	3
5 to 10 years	5	..	4	1
Over 10 years	3	..	1	2
Unknown	6	1	4	1
Total	196	45	101	50

X-ray Diagnosis. A gastrointestinal series was performed in 122 cases. It is to the credit of our *x*-ray department that in 116 of these cases a correct diagnosis of neoplasm was made. Three cases were diagnosed as "ulcer," two others as "extra gastric tumors," and one was reported "negative." Following laparotomy these six cases proved to be gastric cancer. Forty-nine of the cases were located in the pylorus while thirty-six were so extensive as to be listed under "multiple sites," meaning more than one anatomical subdivision of the stomach. (Table VII.)

Table VII
LOCATION BY X-RAY

Site	Number		
Esophagus	2		
Cardia	4		
Fundus	—		
		6	
Lesser curvature	8		
Media	10		
Greater curvature	1		
	—		
		19	
Pylorus		49	
Proximal half	1		
Distal half	2		
Entire stomach	3		
	—		
		6	
Multiple sites		36	
			116

Gastric Analysis. Forty-four cases were tested for free hydrochloric and total acid and six others for free hydrochloric acid only. There were eighteen cases with normal or high free hydrochloric acid of which two had an associated ulcer. (Table VIII.)

Table VIII
GASTRIC ANALYSIS

	None	Low	N	High	Total
Free hydrochloric acid	30	2	9	9	50
Total acid	..	21	15	8	44
Blood	..	..	..	..	23

DISCUSSION

The comparison proved interesting in that it bore out your original impression that selectivity played a great part in determining the outlook in gastric cancer patients. At the Post-Graduate Hospital, where the economic level of clinic patients is definitely higher than that of Bellevue patients, there was already a marked increase in the number of operable and resectable cases. And with the improvement in present day preoperative and postoperative care as well as operative technic, the prognosis should improve. A real problem is that of early diagnosis, and *x*-ray examinations and gastroscopy are essential for what one might call "the prodomal symptoms," such as increasing heartburn or epigastric distress in an adult regardless of age if the early diagnosis is to be made. With a diagnosis of gastric cancer, surgery, if at all possible, should be performed. The patient with a mass in the abdomen clinically, or an extensive lesion roentgengraphically, may prove to be much easier to resect than the one with a small lesion at the cardia. Striking an optimistic note in gastric malignancy are occasional reports of long standing cures following surgery. The ten- and fifteen-year cures following subtotal resections should be reviewed by a group of pathologists in

order to remove any question of doubt as to the diagnosis in view of the generally poor results from a follow-up of gastric carcinoma.

CONCLUSIONS

1. Operability and resectability in gastric cancer are greatly influenced by selection of cases. Comparison of Bellevue with New York Post-Graduate cases illustrates this well.

2. Operability and resectability in gastric cancer are not directly related to duration of symptoms. At Bellevue and New York Post-Graduate Hospitals there was a higher percentage of resectable cases in the group having symptoms for six months to three years than in the group having symptoms for one to six months.

3. Careful *x*-ray examination and gastroscopy are the most dependable means of diagnosis at the present time.

4. Surgery offers the only hope of cure in gastric cancer. That the patient with a short history has no better chance of a cure than the one with a long history presents a real enigma. Increased knowledge of causative factors, type and grade of cancer may solve this problem. Meanwhile, progress must remain in the direction of bringing more patients to surgery whenever possible.

REFERENCES

1. Abrahamson, R. H. and Hinton, J. W. Carcinoma of the stomach; review of 444 cases to emphasize the inadequacy of present methods for an early diagnosis. *Surg., Gynec. & Obst.*, 71: 135–141, 1940.
2. Hinton, J. W. and Trubek, M. The transformation of gastric ulcer into gastric carcinoma. *Surg., Gynec. & Obst.*, 64: 16–21, 1937.
3. Livingston, E. M. and Pack, G. T. End-results in the Treatment of Gastric Cancer. New York, 1939. Paul B. Hoeber.
4. Schindler, R. Early diagnosis and prognosis of gastric carcinoma. *J. A. M. A.*, 20: 1693–1699, 1940.

A METHOD TO PREVENT FRESH COSTAL CARTILAGE GRAFTS FROM WARPING*

GORDON B. NEW, M.D. AND JOHN B. ERICH, M.D.
ROCHESTER, MINNESOTA

AN innate quality of freshly removed costal cartilage is its tendency to undergo distortion by warping. From the viewpoint of plastic surgery, this attribute is most objectionable. When fresh costal cartilage is employed as an implant to correct a facial defect such as a receding chin, a saddle-back deformity of the nose, or a flattened cheek of traumatic origin, it is most disconcerting and not unusual to discover postoperatively that the graft has curled to such an extent as to interfere with the desired cosmetic result. It is regrettable that this tissue, which lends itself so perfectly to both autogenous and homogenous transplantation, which withstands infection so satisfactorily, and which may be cut to any desired contour with ease and accuracy, should possess the undesirable tendency to warp.

However, a method has been evolved by which the physical nature of fresh cartilage may be rapidly altered; thereafter, unless the cartilage has been obtained from a very young person and has been cut to a feather edge, any inclination to bend which it might have possessed will no longer exist. The surgeon may then proceed to cut and shape the cartilage with no fear of the occurrence of subsequent distortion.

Of inestimable value is the discovery made in recent years that cartilage can be transplanted successfully from one individual to another, and that it may be preserved for an indefinite period in aqueous antiseptic solutions maintained at icebox temperatures. These facts, as applied to plastic surgical procedures, permit utilization of cartilage obtained under sterile conditions at necropsy. As is well known, preserved cartilage when cut retains its shape because it has undergone a spontaneous process of fixation which has destroyed its elasticity. Although it is true that we have employed implants obtained at necropsy with much success in a large series of cases, it always has been our opinion that the use of fresh, autogenous, cartilage grafts is preferable to the aforementioned procedure. Consequently, for several years we have sought some means by which fresh cartilage could be prevented from warping.

The one factor which effectually contributed to the end which we sought was a suggestion offered by Dr. J. W. Kernohan of the Sections on Surgical Pathology and Pathologic Anatomy. Since steaming quickly produces fixation of small bits of tissue to be subjected to microscopic examination, Dr. Kernohan proposed that the process of boiling might accomplish with rapidity the desired fixation of costal cartilage, and might thereby avert the tendency of such cartilage to undergo subsequent distortion. Although the results of the experimentation which was prompted by this suggestion differed from our expectations, they constituted a foundation for the method which we now employ and which, without exception, we have found to be completely satisfactory.

Although boiling does bring about fixation of fresh cartilage, it also produces multiple ruptures in the cartilaginous matrix; this action causes deep external cracks and induces an extreme degree of curling which frequently renders the tissue useless as an implant. It was found later, however, that the undesirable effects of boiling could be entirely avoided if the

* From the Section on Laryngology, Oral and Plastic Surgery, Mayo Clinic, Rochester, Minnesota.

solution in which the cartilage was immersed never was permitted to reach the boiling point. The procedure can be carried out most easily by placing the piece of cartilage in a test tube containing water or, preferably, aqueous sodium ethyl mercurithiosalicylate (merthiolate); the tube is then inserted upright in a beaker containing boiling water. Although in time the solution within the test tube will become hot, it will be physically impossible for it to boil if this method is followed. To be exact, the solution will remain 3 or 4°c. below the boiling point of water. Cartilage so heated will warp very little if at all, unless two or more pieces are introduced into the same tube; if this is done, the fragments tend to become moulded together and undergo more or less distortion. It has been discovered, further, that the cartilage which has been subjected to the aforementioned heating process will undergo on cooling a certain amount of warping. Consequently, it is of the utmost importance that heated cartilage be allowed to cool before it is cut to the desired shape. It is well to mention here that if the end of a cartilaginous implant is trimmed to a feather edge, a tendency for such an extremely thin margin to curl slightly may be encountered, whether or not the cartilage previously has been heated. However, such curling may be remedied easily by cutting away that portion of the fine edge which is bent.

Fig. 1. A piece of fresh costal cartilage being heated to overcome its tendency to warp.

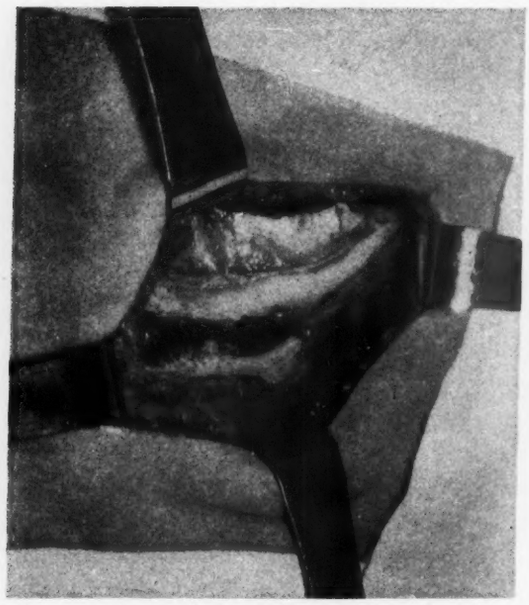


Fig. 2. The cartilaginous portion of the right seventh and eighth ribs is exposed through a transverse incision in the skin. Grafts may be prepared most easily from costal cartilage when the entire thickness of the rib is removed subperichondrially.

As a result of the foregoing experimental work the following technic for heating and cooling cartilage has been evolved, the purpose of which is to nullify any inclination of a finished implant to warp. After a full-thickness section of cartilage has been obtained from one of the patient's ribs, the piece is introduced into a sterile test tube into which is poured sufficient solution of aqueous sodium ethyl mercurithiosalicylate (merthiolate) completely to cover the fragment of cartilage. The tube then is placed in a beaker of water which is allowed to boil for ten minutes. (Fig. 1.) Although not essential, it is advisable that the bottom of the beaker be covered with several layers of gauze. When the cartilage is removed from the test tube, it is immersed, as a final step, in cold sterile physiologic solution of sodium chloride for at least fifteen minutes.

In the performance of any plastic procedure in which a cartilage implant is used, the aforementioned technic for the preparation of this tissue need neither consume additional time during the operation nor demand extra work on the part of the surgeon. After a section of cartilage has been obtained from a rib, the surgeon may proceed immediately to the preparation of the operative field of the facial defect, while a nurse heats and chills the cartilage and the assistant surgeon closes the incision in the thoracic wall. With few exceptions, the defect of the face can be fully prepared for reception of the implant by the time the treated cartilage has been made available for cutting and proper shaping.

FIG. 3. *a*, Lateral preoperative view and *b*, postoperative view of a patient with nasal defect which was corrected by the use of a fresh autogenous implant of costal cartilage. Warping of the graft was obviated by heating and cooling the cartilage before it was cut to the desired shape.

FIG. 4. *a*, Frontal preoperative view and *b*, postoperative view of the patient in Figure 3.

Some surgeons have voiced objections to excision of costal cartilage for use in cosmetic operations, but we have encountered no complications or ill effects secondary to the removal of costal cartilage for such purposes. Naturally, the selection of ribs from which such cartilage is to be taken is of considerable importance. We never attempt to remove cartilage from the left side of the thoracic wall, and on the right side we prefer to obtain cartilage

from the seventh rib. An oblique incision in the skin extending from the center of the sternum just above the xyphoid process to the lower border of the thoracic cage in the region of the right midclavicular line will produce excellent exposure. When the attachments of the pectoralis major and the oblique and rectus abdominis muscles are severed, the cartilaginous portion of the right sixth and seventh ribs (which unite anteriorly with the sternum) and the cartilaginous part of the eighth rib (which joins the costal cartilage of the seventh rib) are effectively uncovered. (Fig. 2.) In the majority of instances, the cartilage of the seventh rib is least difficult to procure and it supplies an amount of material which is adequate for the average implant. We always take the full thickness of a rib, the section of which is removed subperichondrially. If a large graft is required, cartilage from the sixth rib may be used as well. A fine columella, which is essential to the correction of certain nasal deformities, can be constructed from the narrow cartilaginous portion of the eighth rib. Incidentally, unused pieces of cartilage should not be discarded; instead, they may be preserved in an aqueous antiseptic solution in an icebox. This stored material is extremely valuable for use in individuals who have a large defect, such as loss of considerable bone in the frontal region, a circumstance in which the maximal amount of cartilage that could be obtained from the patient would be insufficient fully to correct the deformity.

In conclusion, we would like to reassert that in our experience none of the cartilage implants which have been treated by our method of heating and cooling, as has been described, have undergone the slightest amount of distortion postoperatively. It is our hope that those surgeons who employ fresh, autogenous, cartilage transplants in the correction of facial defects will find that this method affords the high degree of satisfaction which we have experienced, a satisfaction based on the assurance that the desired cosmetic result will not be altered by a failure of the implant to retain its proper contour. (Figs. 3 and 4.)

SURGICAL TECHNIC FOR REMOVAL OF SOLITARY DESTRUCTIVE NEOPLASTIC LESIONS OF THE CRANIUM*

JAMES L. POPPEN, M.D.
Department of Neurosurgery, The Lahey Clinic
BOSTON, MASSACHUSETTS

SOLITARY destructive neoplastic lesions of the calvarium may present a problem both as to diagnosis and removal. The diagnosis is not considered here.

Roentgenograms were not conclusive in two of the four patients treated surgically. That examination of a specimen taken at biopsy is not always infallible was demonstrated in one patient in whom the tumor was believed to be an angioblastic meningioma, but after removal of the entire tumor *en masse* it was found to be metastatic, probably renal in origin. Since biopsy is not always correct and therefore does not settle the problem of removal of the local tumor, and since the latter is associated with various discomforts, it seems reasonable to advise complete extirpation by the method to be described. Granting, of course, that no primary growth elsewhere or other possible metastases can be found, roentgen treatment has been disappointing because the patients are very unhappy with most of their hair out, and in two of our patients roentgen treatment served only to show the protrusion more clearly, whereas previously it was covered with hair. It is a fallacy that blood supply is cut down sufficiently by roentgen treatment to make a difference in blood loss at the time of operation except in the scalp where a rich blood supply is desirable and should never cause technical difficulties.

The underlying principles of the technic are those used in the removal of meningiomas. However, in meningiomas only a small amount of bone has to be discarded and the tumor usually covers much more surface of the brain than the involved bone. In the localized destructive lesions of the bone the tumor is no larger than the involved bone. In order to carry out complete extirpation, the technical steps must be followed carefully in sequence if the procedure is to be executed in an orderly and relatively simple manner.

A "U" shaped incision is made sufficiently large to allow 3 or 4 cm. of a normal edge of bone to be uncovered surrounding the tumor. (Fig. 1*a*.) The scalp is reflected, taking considerable care to stay in the line of cleavage between the galea and periosteum. (Fig. 1*b*.) The periosteum forms an excellent barrier since in none of the patients had the tumor grown through it even though tumor tissue had invaded it. If the periosteum is not allowed to remain undisturbed over the tumor, liquefied and necrotic portions escape and troublesome bleeding from the bone takes place. Also, tumor cells may be transplanted. After the scalp has been adequately reflected an incision is made through the periosteum well away from the tumor edge but completely encircling it. (Fig. 1*b* and *c*.) The periosteum is then stripped away from the normal bone toward the edge of the tumor. In this way enough normal bone is uncovered so that a trough about the width of the usual burr openings can be made surrounding the entire tumor mass. (Fig. 2*a*.) A strip of normal dura about 1 cm. in width will lie uncovered at the bottom of the trough. (Fig. 2*a*.) Bleeding from the bone edges must be controlled with wax. In a dry field the dura is incised, the medial edges are grasped with curved hemostats and gentle traction exerted. (Fig. 3*a*.) As the incision in the dura lengthens, the

* Read before the meeting of the Harvey Cushing Society, Kansas City, Missouri, May 4, 1940.

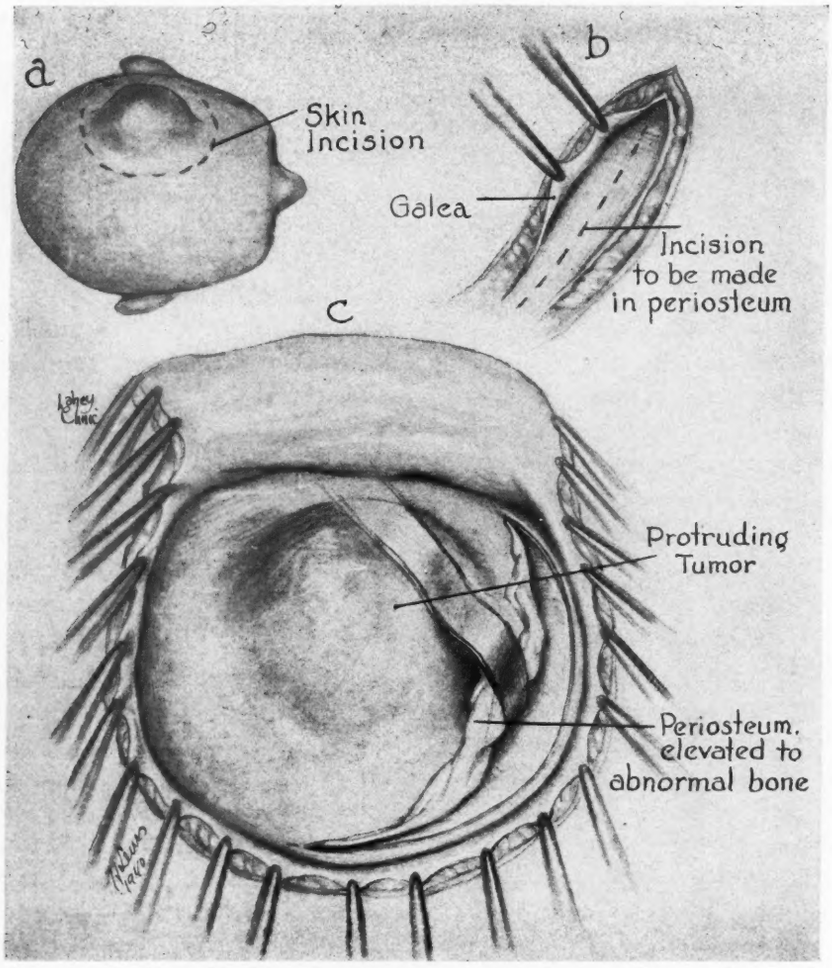


FIG. 1. *a*, Outline of incision showing generous margin around tumor-involved bone; *b*, demonstrates the line of cleavage which must be kept intact between periosteum and galea; *c*, scalp reflected leaving periosteum intact over tumor mass.

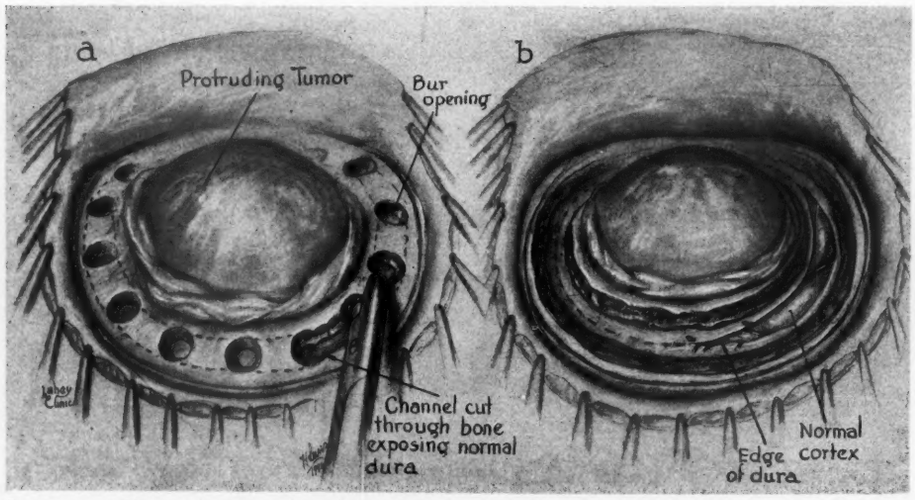


FIG. 2. *a*, The periosteum is reflected up to tumor-involved bone and a channel cut through bone sufficiently wide to allow the dura to be incised as shown in *b*. *b*, Dura incised showing flattened cortex but not involved with tumor.

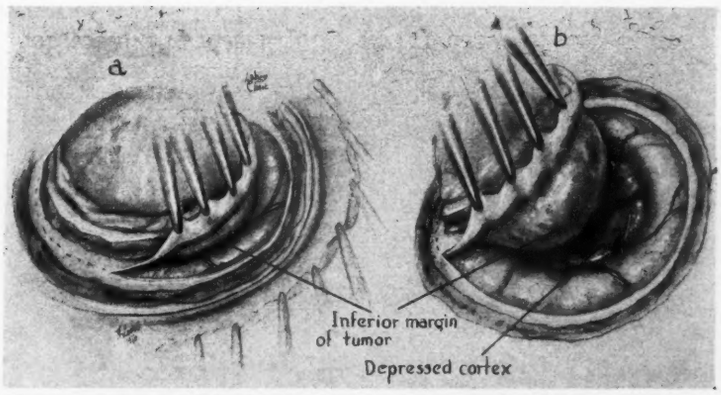


Fig. 3. *a*, the medial edge of the dura is grasped with hemostats and a gentle pull demonstrates the tumor edge which has depressed the cortex; *b*, elevation of tumor from its nest in the cortex.

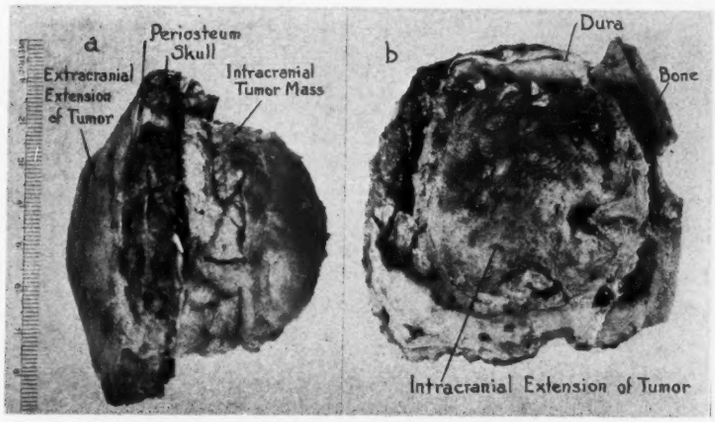
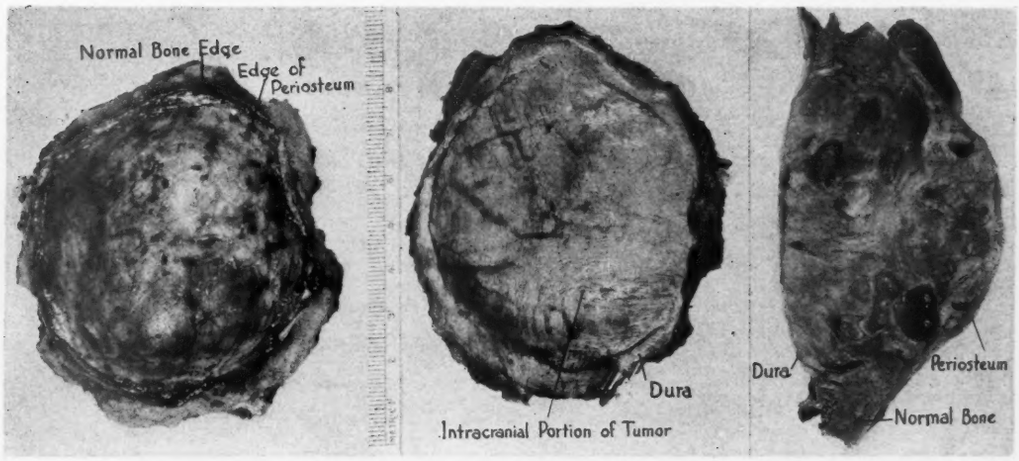


Fig. 4. Side view (*a*) and inferior surface (*b*) of meningioma removed *en masse* showing intracranial, cranial and extracranial extensions of tumor.



a *b* *c*

Fig. 5. Metastatic carcinoma of skull showing (*a*) extracranial, (*b*) cranial and (*c*) intracranial extensions; *b*, dura and intracranial portion of tumor; *c*, sagittal section of metastatic tumor mass.

tumor gradually tilts from the nest that it has made in the cortex. (Fig. 3*b*.) If the tumor has not grown through the dura, it

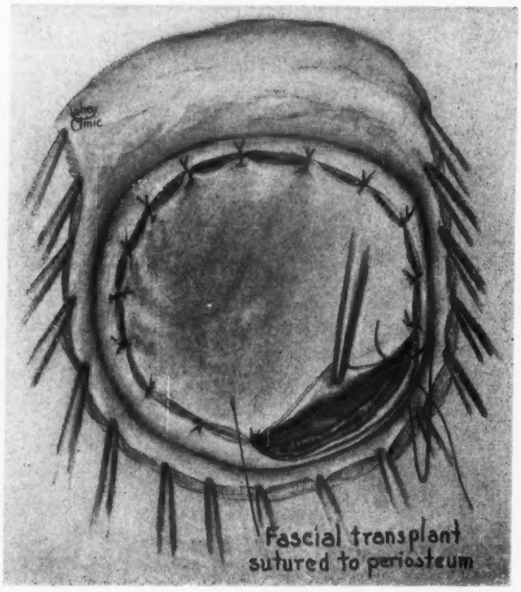


FIG. 6. Dural defect covered with fascial transplant.

readily is lifted from the cortex and perhaps only one or two cortical veins which enter need be occluded with the electrocoagulation and divided. However, if it has grown through the dura as in a meningioma, a few arteries will be encountered as well as the veins, and considerable care must be exercised in brushing the cortex from the tumor edge as traction is exerted on the dural edge. As the tumor is slowly tilted from its base the vessels can be readily occluded and divided. Photographs of specimens removed are shown in Figures 4 and 5.

After the entire mass has been removed, the dural edge remaining may be sutured to the periosteum avoiding chances of a postoperative clot. If the tumor is near the sagittal sinus and over the rolandic vein, it is unwise to suture the dural margin to the periosteum since it may occlude the channels in the dura by which rolandic venous blood enters, often causing sufficient stagnation for thrombosis to take place. This occurred in one of our cases.

If the tumor is definitely metastatic there is some question as to the wisdom of performing a plastic operation at the time the tumor is removed and the dural defect is repaired with a layer of fascia. (Fig. 6.) However, if a nonirritating substance such as a thin vitallium plate is at hand, it can be firmly anchored in place. If the tumor is a meningioma, a bone graft is probably advisable unless vitallium proves to be as satisfactory in the skull as in other bones of the body. Unfortunately, I have not used it but expect to have as nearly the exact size and shape necessary to cover a defect as can be determined at hand in the future. Its advantages, of course, are its lightness of weight, strength and elimination of any necessity of obtaining bone from other sources or from the immediate vicinity of the skull. The latter necessarily would increase the blood loss and time of operation.

SUMMARY

A method is demonstrated that allows complete extirpation *en masse* of a single solitary, destructive lesion of the skull, including extracranial and intracranial local extensions. This procedure has been carried out in four cases, with excellent technical results.

SUPPRESSION OF LACTATION BY STILBESTROL*

OSCAR H. BLOOM, M.D.
BROOKLYN, NEW YORK

ESTRONE and estrone-like substances are assuming an ever increasing rôle in the suppression and inhibition of lactation. Out of the welter of controversial reports by clinical and laboratory investigators,[2] the rationale for this type of therapy seems to be based on the physiologic suppression of the anterior pituitary, with the resulting inhibition in the production of the lactogenic hormone, variously designated as prolactin,[1] mammotropin[6] and galactin.[7] Mayor,[3] Ramos and Colombo,[4] and a host of others obtained gratifying results with the natural estrogenes.

Dihydroxydiethyl stilbene, commonly called stilbestrol, possesses the same pharmacologic activity as natural estrogenes although chemically unrelated. Because of its marked therapeutic efficacy by oral administration, its use is enhanced in the inhibition of lactation. This is evidenced by an ever growing number of reports in both American and foreign journals. Of still greater importance is its apparent freedom from toxic effects on the parturient. Greenhill,[10] believes this to be due to a special tolerance possessed by the postpartum patient.

Obviously, there are numerous occasions when the suppression of lactation becomes a necessity. The indications are not only those relating to postpartum maternal morbidities, but, in this streamline age, the physician is often compelled by the patient to institute such measures because of economic and social reasons. In this series of cases, forty or about 37 per cent demanded such therapy, whereas twenty-six or 23.6 per cent were actually due to maternal debilities.

ANALYSIS OF 110 CASES

Method. The greater number, in this series, were private patients under the supervision of their own physicians. The administration of stilbestrol was under the care of our supervisor of nurses, who allotted the drug to the patients at the request of the attending physician. A record of each case was kept on each individual chart as long as the patient was in the hospital. Reactions were carefully watched for and recorded by the nurse in charge on each floor. The following table outlines the indications for the suppression of lactation.

TABLE 1

A. Maternal Debility Due to:		
1. Postpartum hemorrhage	2	
2. Anemia due to placenta previa	1	
3. Secondary anemia	1	
4. Bronchial asthma	1	
5. Postpartum infection	1	
6. Cardiac disease	3	
7. Acute mastitis	2	
8. Toxemia	9	
9. Following cesarean section	4	
10. Postpartum psychosis	1	
11. Previous mastitis	1	26
B. Refusal to Nurse for Social or Economic Reasons		40
C. Inverted, Tender or Fissured Nipples		24
D. Fetal Causes:		
1. Still-births and neonatal deaths	10	
2. Unable to nurse (immaturity)	10	20
		110

Following the dosage suggested by Mucklé,[11] stilbestrol was administered orally in tablets of 5 mg. three times a day for two days or a total of 30 mg. to the first 103 patients. The next seven patients were given 45 mg. at the same rate of 15 mg. per day. It is noteworthy that no other adjunct therapy was used; no restriction of fluids, no tight breast

* From the Obstetrical and Gynecological Service of the Beth-El Hospital, Brooklyn, New York, Dr. A. Koplowitz, Director.

binders, no massage or stripping of the breasts, no atropine, no camphorated oils and no saline cathartics, during the administration of this drug.

TABLE II
ANALYSIS OF RESULTS
Dose: 30 mg. (15 mg. for two days)

Days Postpartum	No. Cases	No. with Total Relief	No. with Return of Lactation			No. with Pseudolactation
			No. Requiring Added Stilbestrol	No. Given $MgSO_4$	Total	
1st and 2nd	20	16	1	3	4	4
2nd and 3rd	19	16	1	2	3	4
3rd and 4th	27	25	1	1	2	8
4th and 5th	14	14	0	0	0	6
5th and 6th	13	12	1	0	1	4
6th and 7th	3	3	0	0	0	2
7th and 8th	4	4	0	0	0	2
8th and 9th	1	1	0	0	0	1
9th and 10th	1	1	0	0	0	1
5th week	1	1	0	0	0	1
Total	103	93	4	6	10	33
Per cent	...	90.29	..	..	9.71	33.8

Fortunately, the author was able to follow up the entire group of patients, due to the co-operation of the attending physicians, who kept him informed of the progress of each case even after the patient had left the hospital. From the above analysis, it is obvious that in this series there was absolute failure in about 10 per cent of the cases. Early in the study, several co-operating physicians administered magnesium sulfate to six patients as adjunct therapy without the knowledge of this investigator. Since the outcome of the treatment of these six cases is problematic without this meddlesome therapy, they are included with the absolute failures. About one-third of the cases had a recurrence of some watery secretion approximately seventy-two hours after the administration of the last dose. This occurrence may be termed pseudolactation, for the secretion was watery and disappeared without any therapy whatever.

A group of seven patients were given 45 mg. of stilbestrol in the same dosage as above. Although this group is too small to permit of an accurate estimate of the therapeutic effects of the greater dose, it tends to indicate that there is no need for any larger dosage. While there were no absolute failures in this group, pseudolactation occurred in about the same ratio. In addition, two patients complained of severe headaches, which promptly yielded to acetyl salicylic acid. Whether or not these headaches were due to the drug is speculative.

One lactating patient developed acute mastitis five weeks postpartum. The attending physician administered 30 mg. of stilbestrol. About forty-eight hours after its administration, the acute mastitis subsided, the breasts became dry and a previous temperature of 104°F. became normal with no return of the condition.

Three other cases not included in this study were interesting enough to bear description. A cardiac patient was given 5 mg. about two days after delivery. Shortly thereafter she developed dyspnea, palpitation and nausea. It was deemed advisable to discontinue the drug in spite of the fact that the symptoms pointed rather to the cardiac condition than to the use of the drug. Another patient decided to nurse her baby after 15 mg. of the drug were given. There was no diminution in the quantity of the milk from this dose. Another patient with excessive lactation was given 14 mg. of stilbestrol to diminish the flow of milk In this it was entirely successful.

CONCLUSIONS

Stilbestrol successfully suppressed lactation in over 90 per cent of a series of 110 cases. It was found to be safe and easy of administration. No other therapy was necessary at the same time.

The author wishes to express his appreciation to E. A. H. King, of Crookes Laboratories, Inc. for supplying the stilbestrol used in this study.

The author thanks Miss Edith Miller, R.N., Supervisor of Nurses, for her administration of

the stilbestrol and her co-operation in this study.

REFERENCES

1. RIDDLE, O., BATES, R. W. and DYKSHORN, S. W. *Am. J. Physiol.*, 105: 1, 1933; RIDDLE, O., BATES, R. W. *Endocrinology*, 17: 6, 1933.
2. WERNER, A. A. Endocrinology—Clinical Application and Treatment. P. 321. Philadelphia. Lea & Febiger.
3. MAYOR, J. M. *Zentralbl. f. Gynäk.*, 60: 2379, 1936.
4. RAMOS, A. P. and COLOMBO, E. *Deutsche med. Wchnschr.*, 64: 782, 1938.
5. COOK, J. W., DODDS, E. C. and HEWLETT, C. L. *Proc. Roy. Soc.*, 114: 272, 193, 1934.
6. CATCHPOLE, H. R. and LYONS, W. R. *Anat. Rec.*, 55: 49, 1933.
7. GARDNER, W. U. and TURNER, C. W. *Research Bulletin* 196, *Univ. of Missouri*, pp. 1–60, 1933.
8. DAVIS, M. W. *Am. J. Obst. & Gynec.*, 39: 938, 1940.
9. FREED, S. C. et al. *J. A. M. A.*, 115: 2271, 1940.
10. GREENHILL, J. P. Year Book of Obs. & Gyn., p. 604, 1939, and personal communication.
11. MUCKLÉ, G. W. *Am. J. Obst. & Gynec.*, 40: 133–134, 1940.

THE treatment of Hirschsprung's disease might be summarized by pointing out that no one method or combination of methods is uniformly satisfactory in all patients, and indeed it is almost impossible to obtain a complete cure in any of these children. However, this note of pessimism must not obscure the fact that close medical supervision, combined with one or more of the surgical procedures when specifically indicated, can appreciably increase the emptying power of the bowel and can greatly improve the general health of the patient.

From—"Abdominal Surgery of Infancy and Childhood"—by Ladd and Gross (W. B. Saunders Company).

Case Reports

SEGMENTAL ABDOMINAL HETEROTAXY

SITUS INVERSUS VISCERUM ABDOMINIS PARTIALIS*

JOSEPH I. ANTON, M.D.,
Associate Attending Surgeon, Beth-El Hospital

CHARLES E. PANOFF, M.D.
Chief Urologist, Beth-El Hospital

AND

MILTON B. SPIEGEL, M.D.
Assistant Gynecologist, Beth-El Hospital

BROOKLYN, NEW YORK

EXAMINATION of the entrails of man and beast is a practice old as antiquity. It is depicted in ancient manuscripts and biblical lore. In Egypt, a considerable knowledge of visceral anatomy had been obtained through the process of embalming, and the Israelites possibly carried with them some of this learning. The Bible gives directions for the dissection[1] of animals slaughtered in sacrifice and enumerates the specific abdominal contents[2] required for the altar. Inspection of the viscera of sacrificed animals was a prominent phase of divination, or augury. Among the Babylonians, soothsaying was concentrated in the liver[3] (hepatoscopy) and is mentioned in the Bible[4] wherein all such forms of divinations and necromancy are severely condemned.[5] However, the early Romans absorbed from the Etruscans a class of soothsayers whose art consisted especially in deducing the will of the gods from the appearance presented by the entrails of a slain victim. This art of haruspicy became highly developed. Its votaries were variably known as extispices (inspector of entrails), aruspices (entrail observers), or haruspices. They were held in high esteem at one time and Claudius even went so far as to establish a "collegium" of haruspices presided over by an Haruspex Maximus[6] with a law of standards regulating their prophecies. To please the gods, the victim must be without spot or blemish and the variable visceral patterns presented the omens for interpretation and forecasting. In the course of events, it was inevitable that bizarre visceral anomalies would be noticed, commented upon and recorded. Transposition of the viscera may have been noted since the time of the ancients, evincing, as the case may be, joyous portents or grave forebodings.

Pure situs inversus (mirror-image) remains merely a medical curiosity except when it engenders complications in a pathologic process requiring surgical interference or when it presents a problem inherent to the heterotaxy itself. Situs inversus has long since ceased to be regarded as a rarity. Mass routine examinations by school, insurance, military and industrial organizations, coupled with the more frequent use of roentgenography and fluoroscopy, have uncovered numerous benign examples.

Partial situs inversus may occur in a system, an organ or a viscus. However uncommon a pure situs inversus remains, it is obvious that a partial heterotaxy is still more infrequent. Dexicardia represents

* From the Surgical and Urologic Services of Beth-El Hospital, Brooklyn, New York.

the greatest percentage of this type. Abnormal position of the intestinal tract is the result of some disturbance of migration, rotation, descent or fixation during the embryonic development of the alimentary canal. Most of these occur in the midgut, malposition of the fore- and hindgut being extremely rare. Dott[7] states: "Error in location or attachment of that part of the foregut situated within the abdomen (stomach and duodenum down to the biliary papilla) is excessively rare." Interest in this phase of the subject was stimulated when we presented a case that fell into the group of this rare type.

In former times, when necropsy material provided the only means of diagnosing the condition, Risel[8] (1909) reported two cases of his own and collected several varieties of partial heterotaxy involving different segments or group of segments of the body. Soleil[9] (1936) reviewed the entire subject of total and partial heterotaxy, discussing and classifying the various types. The case herewith reported falls into his classification of "interversion abdominale segmentaire sus-ampulaire (situs inversus abdominal partiel)," of which type he claims to have collected only four cases. Review of his bibliography, however, reveals that only two of these cases[10,11] are similar to ours; the others[12,13] are more a torsion of the stomach, or "volvus ventriculi" than a true transposition. We cannot accept Soleil's estimation of the incidence of this condition, since he failed to include Risel's[8] collection of several cases proved by specific necropsy findings.

In order to understand better this congenital anomaly, we believe it necessary to review briefly the early embryonic development of the intestinal tract, stressing particularly the foregut.

Developmental Embryology of the Foregut. The embryonic disk, composed of three germ layers, primarily lies flat upon the yolk sac. The first indication of the alimentary tract is the entodermal vesicle of the zygote. By a constriction, the vesicle becomes divided into an intra-embryonic portion (the future alimentary canal and its appendages) and an extra-embryonic portion (the yolk sac); the intervening constriction is the vitello-intestinal duct. As the embryo elongates, the alimentary canal takes the form of a tube and its subdivisions become apparent.

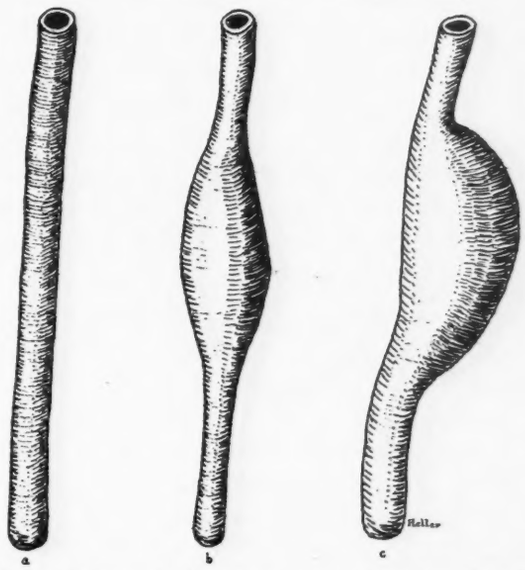


Fig. 1. Schematic diagram representing three stages in the differentiation of the mammalian stomach. *a*, Early undifferentiated stage in which the stomach appears as a tube of uniform caliber; *b*, spindle-shaped gastric dilatation; *c*, typical mammalian eccentric gastric dilatation. (After Huntington.)

The intestine rapidly becomes elongated and three regions are recognizable. The cephalic portion, extending as far as the opening into the yolk sac is called the foregut. The portion over the opening is the midgut. The caudal portion, as far forward as the opening into the yolk sac, is the hindgut. In subsequent stages the subdivision is based on form, the parts constituting three distinct loops. It is based upon the blood supply; this is distinct for each part: the celiac axis, superior mesenteric and inferior mesenteric arteries, respectively. It is largely applicable to function: the foregut, digestive; the midgut, absorptive; the hundgut, excretory. In subsequent stages, the point where the liver arises marks the caudal limit of the foregut; the left colic flexure marks the cephalic limit of the hindgut. In the mean-

time, the midgut grows longer, while the communication with the yolk sac has become relatively much smaller and

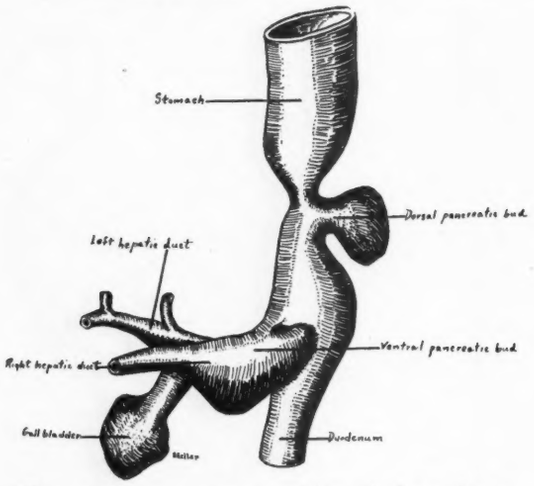


FIG. 2. From a reconstruction of the anlagen of the liver and pancreas and a part of the stomach and duodenum of a human embryo of four weeks. (After Felix.)

appears as a slender structure, namely, the yolk stalk, attached to the midgut. All are suspended by the common dorsal mesentery. A ventral mesentery extends between the ventral abdominal wall and the ventral surface of the intestinal tract, forming a partition which divides the body into a right and left half.

Stomach. The abdominal portion of the foregut forms the stomach and the duodenum down to the biliary papilla. The anlage of the stomach can be recognized in embryos of 5 mm. as a slight spindle-shaped enlargement of the primitive gut a short distance cranial to the yolk stalk. The dilatation goes on more rapidly on the dorsal than on the ventral side, thus producing the greater and lesser curvature, respectively. (Fig. 1.) The greater curvature is attached to the dorsal body wall by the dorsal mesogastrium, which is part of the common dorsal mesentery. The lesser curvature is attached to the ventral body wall by the ventral mesogastrium. (Fig. 3.) At this time, the stomach presents a right and left surface, a ventral concave border (the lesser curvature) and a dorsal convex border (the greater curvature), with the esophageal entrance at the cephalic end of the organ, while the pyloric transition occupies the distal, caudal extremity. In further devel-

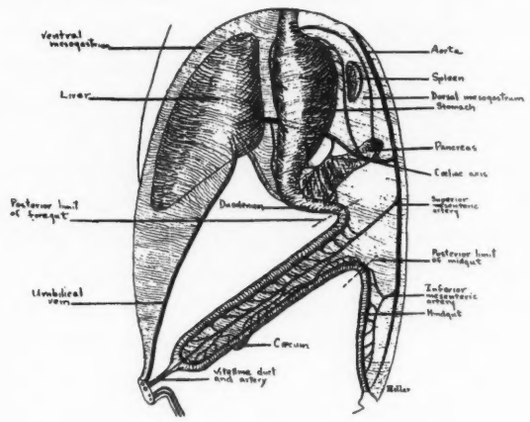


FIG. 3. Diagrammatic representation of the embryologic alimentary tract, its appendages and blood supply, showing its anatomic and functional division into foregut, midgut and hindgut. (Modified after Sabotta.)

opment, the greater curvature becomes much more prominent and the organ as a whole changes its position, the latter process beginning in embryos of 12 to 14 mm. The cephalic (cardiac) end moves toward the left side of the body, the pyloric end towards the right. At the same time, the stomach rotates, the greater curvature turning caudally from its dorsal position. The result is that the organ comes to lie in an approximately transverse position in the body, with the cardiac end to the left, the pyloric end to the right, the greater curvature directed caudally and the lesser curvature directed cephalad.

Duodenum. The segment of small intestine situated between the pylorus and the beginning or point of departure of the proximal or descending limb of the umbilical loop, develops into the duodenum. This portion of the small intestine is indicated early in embryos of 2.15 mm. Somewhat later, in embryos of 4.10 to 5 mm. in length, it becomes additionally marked by the origin of the pancreatic diverticulum. The duodenum, at first straight (Fig. 2), now begins to curve, forming a short duodenal loop or bend. In embryos

of six weeks, the duodenum forms a simple loop placed transversely below the pyloric extremity of the stomach. Its mesentery fuses with the peritoneum of the dorsal body wall and the duodenum thus becomes a fixed portion of the intestinal tract. (Fig. 3.)

Liver and Gallbladder. In point of time, the liver is the first accessory structure to develop by budding from the primitive alimentary canal. In embryos of about 3 mm. a longitudinal ridge-like evagination develops from the entoderm on the ventral side of the gut a short distance caudal to the stomach, that is, in the duodenal portion of the gut. The cephalic part of the evagination is solid and, being destined to give rise to the liver proper, is called the pars hepatica. The caudal part is hollow, its cavity being continuous with the lumen of the gut, and is destined to give rise to the gallbladder; hence, it is called the pars cystica. Beginning at both the cephalic and caudal ends, the evagination as a whole becomes constricted from the gut until (in embryos of about 8 mm.) its only connection with the latter is a narrow cord of cells which is the anlage of the ductus choledochus. The pars hepatica, by this time, has enlarged considerably and remains attached to the ductus choledochus by a short cord of cells, the anlage of the hepatic duct. The primitive hepatic duct is directed cephalad in the mesogastrium between the vitelline duct and the stomach. (Fig. 2.)

In embryos measuring 4.25 mm. the duct is 0.24 mm. long. Later (in embryos of 8 mm.) the primitive single duct divides into two secondary branches, indicating, even at an early stage, the adult arrangement of the duct, as formed by the union of the right and left hepatic ducts.

The pars cystica has also become larger, its distal portion being somewhat dilated, and is connected with the ductus choledochus by the anlage of the cystic duct. (Fig. 2.) The pars cystica grows into the ventral mesentery and thus becomes surrounded by mesodermal tissue. The proximal portion continues to elongate to form the cystic duct and the distal portion becomes larger and more dilated to form the gallbladder. (Fig. 2.)

The parts hepatica, or anlage of the liver proper, also grows into the ventral mesentery, thus becoming surrounded by mesodermal tissue. The mesodermal tissue gives rise to the fibrous capsule of Glisson and to the small amount of connective tissue within the gland.

Although the liver develops as a series of outgrowths from the original evagination, there are certain features in its development which distinguish it from glands in general. The outgrowths come in contact with the omphalomesenteric veins which are situated in the ventral mesentery. They push their way into and through the veins, breaking them up into smaller channels. They anastomose freely with one another and the veins send off branches which circumvent these channels. Thus there is formed a network of trabeculae of liver cells, called hepatic cylinders, the meshes of which are filled blood vessels. Therefore, the liver is distinguished from other glands in general, in that the hepatic cylinders, which are comparable to the smaller ducts and terminal tubules of other glands, anastomose, and in that the blood vessels are broken up by the growth of these cylinders.

All the blood carried to the liver by the omphalomesenteric veins must follow the tortuous course of the sinusoids before being collected again and passed on to the heart. When the umbilical veins come into connection with the liver they also join in the sinusoidal circulation. Subsequently, however, a more direct channel—the ductus venosus—is established and persists for a short time. This is probably due to the large volume of blood brought in by the umbilical veins. Finally the ductus venosus disappears and the sinusoidal circulation remains as the permanent form.

The lobes of the liver develop in a general way in relation to the great venous trunks which, at one time or another, pass

into or through the gland. The anlage of the organ grows into the ventral mesentery, subsequently becoming enclosed in the septum transversum. In so doing, it encounters the omphalomesenteric veins, and forms, in relation to the latter, two incompletely separated parts which have been called the dorsolateral lobes. When the umbilical veins enter the liver, a more ventral, medial mass is formed. This becomes incompletely separated into two parts which give rise to the permanent right and left lobes. The right becomes the larger. The right umbilical vein loses its connection with the liver. After birth, the left, which lies between the right and left lobes, degenerates into the round ligament of the liver. The other lobes arise secondarily as outgrowths from the right primary dorsolateral lobe, the caudate (lobe of Spigelius) from its inner (medial) surface, the quadrate from its dorsal surface.

The liver, as a whole, grows rapidly and by the second month is relatively large. During the third month it fills the greater part of the abdominal cavity. After the fifth month it grows less rapidly and the other intra-abdominal organs overtake it, so to speak, although at birth it forms one-eighteenth of the total weight of the body. After birth it actually diminishes in size, comparatively. The right lobe is from the beginning larger than the left, and after birth the predominance increases.

Pancreas. The epithelium of the pancreas, like that of the liver, is a derivative of the entoderm. It arises from two (or three) separate anlages, one dorsal and one (or two) ventral. The dorsal anlage appears first as a ridge-like evagination from the dorsal wall of the gut, slightly cephalad to the level of the liver. (Fig. 2.) It appears about the same time as the liver or a little later. (In embryos of 8 mm. (four weeks) it appears as a small spherical outgrowth connected by a slightly narrower stalk with the epithelial intestinal tube.) The mass of cells grows into the dorsal mesentery and becomes constricted from the parent epithelium except for a thin neck which becomes the duct of Santorini. A little later two other diverticula appear from the epithelium of the primitive hepatic duct, and not directly from the duodenum. This distal ventral outgrowth is from the beginning closely connected with the similar embryonic outgrowth from the enteric tube which is to form the liver. The diverticulum continues to develop and becomes constricted from the parent epithelium, leaving only a thin neck which becomes the duct of Wirsung, which is closely connected with the end of the common bile duct at the intestinal opening common to both.

The smaller ventral pancreas grows to the right and then dorsally into the mesentery, passing over the right surface of the portal vein, until it meets and fuses with the proximal part of the larger dorsal pancreas. In embryos of the sixth to seventh week, the two glandular outgrowths have become fused into a single mass at a point which corresponds exactly to the divergence of the duct of Santorini from the main pancreatic duct (duct of Wirsung) in the adult gland, the ventral anlage giving rise to the head, the dorsal anlage to the body and tail of the pancreas. A communication is established between the two ducts, and the dorsal duct (Santorini) usually disappears, leaving the ventral (Wirsung) as the permanent duct opening into the ductus choledochus. (Fig. 3.)

As the pancreas grows into the dorsal mesentery it lies in the dorsal mesogastrium between the greater curvature of the stomach and the vertebral column; and since the dorsal mesogastrium at first lies in the medial sagittal plane, the pancreas is similarly situated. After the sixth week, however, as the stomach changes its position, the pancreas is carried along with the mesogastrium and comes to lie in a transverse plane, with its head to the right and embedded in the bend of the duodenum, and its tail reaching to the spleen on the left. (Fig. 3.) The organ as a whole is at first movable along with the

mesentery, but when it assumes its transverse position, it lies close to the dorsal abdominal wall. The mesentery then fuses with the adjacent peritoneum and the pancreas is firmly fixed.

The connective tissue of the pancreas is derived from the mesodermal tissue of the mesentery. As the processes or buds which form the ducts and terminal tubules grow out from the primary masses, they penetrate the mesodermal tissue and are surrounded by it. Groups of tubules form lobes and lobules and the entire gland is surrounded by a capsule of connective tissue.

Spleen. The first anlage of the human spleen appears early in the fifth week. It is represented by a triangular cellular elevation in the left side of the dorsal mesogastrium opposite the urogenital fold and to the left of the pancreas, at the level of the fundus of the stomach. (Fig. 3.)

The ultimate origin of the spleen is not yet settled and the details of its later development are still obscure. For some time, the spleen was considered as a derivative, primarily, of the mesenchyme in the region of the dorsal mesogastrium. More recently, however, investigators have taken the view that it arises partly, or possibly entirely, from the mesothelium (celomic epithelium) of the dorsal mesogastrium. In the human embryo, during the fifth week, the anlage of the spleen appears as an elevation. This elevation is produced by a local thickening and vascularization of the mesenchyme, accompanied by a thickening of the mesothelium which covers it; furthermore, the mesothelium is not so distinctly marked off from the mesenchyme as in other regions. Cells from the mesothelium then migrate into the subjacent mesenchyme and the latter becomes much more cellular. The migration is brief, and in embryos of about forty-two days migration has ceased and the mesothelium is again reduced to a single layer of cells. The elevation becomes larger and projects into the body cavity. At first it is attached to the mesentery (mesogastrium) by a broad, thick base, but as development proceeds, the attachment becomes relatively smaller and finally forms only a narrow band of tissue through which the blood vessels (splenic artery and vein) pass.

DISCUSSION OF EMBRYOLOGY

The configuration of a human embryo of a few millimeters is symmetrical on a median sagittal plane, the right and left sides being mirror images of each other. By atrophy or excessive development of a certain part, by rotation, torsion or migration, an internal asymmetry is produced which identifies the right from the left side. Various phases of visceral rearrangement of the abdominal portion of the foregut occurs in the course of the first few months. The rarity of true malposition of the foregut and hindgut as contrasted to developmental errors in the disposition of the midgut (the intestine from the biliary papilla to the left third of the transverse colon) is due to its less complicated evolution and its natural disposition in the abdomen.

It seems that the vertical position and the physiologic differentiation of the upper extremities, which are prehensile organs in the human and not supporting organs as in the quadrupeds, involve a flattening of the anteroposterior direction and necessitate this visceral rearrangement. Certain vertebrates, such as the cat, conserve the median arrangement to the adult state.

Various theories as to the causes of transposition of the organs have been advanced. The explanation of total situs inversus may be hypothesized on the old theory of Serre and Forster, based upon the formation of "double monsters." Serre,[14] in 1832, showed a determining rôle in the unilateral atrophy of the omphalomesenteric artery, producing an asymmetric development of the liver. If the left lobe were evolved in the location of the right lobe of the liver, there might result a subdiaphragmatic interversion.

But whether this interversion would be confined to this segment cannot be assured. The primary origin of the asymmetry is still lacking.

In the most plausible theory the anomalous condition is considered due to the influence of the large venous trunks in the abdominal region, especially on the position of the liver and stomach.

Primarily, the omphalomesenteric veins pass cranially through the mesentery. Later they form two loops around the duodenum. Then the left half of the upper ring and the right half of the lower disappear, the common venous trunk thus following a spiral course around the duodenum. After the veins come into connection with the liver, the right vein atrophies and the left increases in size and becomes the single, large umbilical vein of later stages. The right lobe of the liver becomes the larger. If, as is maintained by some investigators, the usual position of the stomach and liver is due to the persistence of the left venous trunks, a persistence of the right venous trunks instead would afford a plausible explanation of the transposition of these organs. Certainly, a reversal in the position of the stomach would cause a reversal in the position of the duodenum and its derivatives. Since only the abdominal portion of the foregut is developed in conjunction with these venous trunks, it is not unreasonable to attribute the transposition of the stomach, the duodenum and its derivatives (liver and pancreas) and other associated organs (the spleen), directly or indirectly to the persistence of the right venous trunks, without disturbing the development and position of the remainder of the intestinal tract.

We are unable to state or to quote any authority which can plausibly hypothesize what disturbing influence tilts the balance of asymmetric development. The factor producing such anomalies is probably present in the defective fertilized ovum. In a majority of cases, transposition of the viscera causes no disability and, at first sight, there appears to be no reason why it should not be as common as the normal position; for when there is no selective advantage or disadvantage between a dominant and a recessive, they may occur in any proportion in a population and still remain in equilibrium.[15] However, there appears to be much evidence that transposition of the viscera is associated with other congenital anomalies—atresia of the duodenum, polycystic kidney, congenital morbis cordis, absence of, or multiple spleens. Anomalous lobulations of the spleen (lien lobatus), such as was present in our own case, are not rare, and are fully explicable by the multilobular embryonal anlage. Congenital lobulations of the topography of the spleen are usually dependent upon other malformations. A case of multilobular spleen with transposition of the viscera has recently been reported.[16] Besides such congenital malformations, heterotaxy appears in frequent association with a syndrome of hypertrophic rhinitis, nasal polyposis, sinusitis and bronchiectasis, more frequently than can be accounted for by chance.[17]

A linguiform enlargement which may protrude from under the lower margin of the larger lobe of the liver is known as Riedel's lobe. The lobe may have a broad base of attachment, such as was found in our own case, or may be connected to the liver by a thin pedicle. Its occurrence is more common in women than in men, and it is often attributed to the effects of tight lacing or the wearing of a tight belt around the waist. But since it has occasionally been found in quite young children, it must be regarded rather as an anatomic abnormality.

CASE REPORT

Mrs. F. K., a white female, age forty, married, was admitted to the Urologic Service of the Beth-El Hospital, August 21, 1938, complaining of upper abdominal pain of two weeks' duration. The patient had suffered from flatulence and "sour stomach" for the past ten years.

Menses began at the age of fourteen, were regular, of the twenty-eight-day type and lasted about four to five days. She did not suffer from menorrhagia or metrorrhagia; menopause occurred at the age of twenty-six.

Palpitation on exertion was her only complaint referable to the cardiovascular system. Seven years ago, she had been a patient at another hospital where she was treated for epigastric distress and at that time a mass was found in the epigastrium. There was no venereal history.

Physical examination revealed that the patient was fairly well nourished, mentally clear, intelligent and quite co-operative. Blood pressure 130/90; temperature 99°F.; pulse, 84; respiration, 22. The neck presented bilateral scars of previous incisions. The lungs were negative to percussion and auscultation. The heart was in the left side of the chest; apex beat was in the fifth interspace, three and one-half inches from the midline but otherwise was essentially negative. Abdominal examination revealed a tender mass in the left upper quadrant, extending from the left subcostal margin to the level of the umbilicus which, on percussion, was found to extend laterally to the left flank. A dull note was elicited over the entire mass. The lower margin of the tumor mass was round and discrete. The remainder of the abdomen was flaccid. Some tenderness was also elicited on palpation in the right iliac fossa. The splenic edge was not palpable. The right kidney was not felt. The left kidney, on palpation, could not be distinguished from the mass. Rectal and vaginal examinations disclosed a uterus smaller than would be expected for her parity. Neurologic examination was negative.

Blood chemistry studies were within normal limits. Wassermann and Kahn tests were negative. Urine, plus 2 albumin, otherwise negative; red blood cells, 6,200,000; hemoglobin, 17 Gm.; coagulation time eight and one-half minutes; platelet count 350,000; fragility began at 0.42 and was complete at 0.34; white blood cells, 18,000; staff neutrophiles 6 per cent; segmented neutrophiles 86 per cent; eosinophiles 2 per cent; lymphocytes 3 per cent; monocytes 3 per cent.

A retrograde pyelogram showed both kidneys normal in size and shape. The left kidney appeared to be high in the abdomen but the urographic outline was normal. Mass density was noted in the left midabdomen and was extrinsic to the renal shadow. When these roentgenograms were interpreted by Dr. M. Dannenberg, he was of the opinion that we were dealing with a case of transposition of viscera. The gas shadow in the right upper quadrant (Fig. 5) he believed represented the outline of the stomach and suggested a gastrointestinal series. However, the patient was operated upon before his report was received. Clinical diagnosis: Retroperitoneal neoplasm.

Fig. 4. Diagrammatic representation of the anatomic topography as constructed from operative findings.

Operation was performed on August 29, 1938, under spinal anesthesia. The abdominal cavity was opened through an upper left rectus-splitting incision. Exploration revealed that the left vault of the diaphragm was occupied by the larger lobe of the liver which was markedly enlarged. A rounded tumor mass, 10 cm. long by 5 cm. in width, soft in consistency and of a darker hue than the liver, was found adherent to the undersurface of the transposed right lobe of the liver. The rounded edge of this tumor mass extended about 3 cm. below the free border of the liver. The examining fingers could be hooked around a free posterior pole of the tumor mass which was presumed to be a Riedel's lobe. In the angle between the outer margin of this ectopic lobe and the free lower margin of the liver was found a globular, collapsible body, surrounded by omentum except for its superior surface which was thought to be the gallbladder. The viscus was carefully separated from its bed of adhesions by sharp

and blunt dissection and a cholecystectomy was performed.

Further exploration by palpation and direct vision revealed the left kidney to be of normal size and shape, situated high, at about the level of the ninth rib. The spleen was absent from the left upper quadrant and was found in the right upper quadrant. It consisted of five separate lobes. The stomach and duodenum were transposed to the right side of the abdomen. The gallbladder was transposed to the left, as previously mentioned. The head of the pancreas was felt to the left of the midline in the curve of the duodenum. The cecum and appendix occupied the right lower quadrant and the rest of the abdominal viscera were in their normal positions. (Fig. 4.) The uterus was atrophied, as had been noted on vaginal examination and the adnexa were negative to palpation.

A cigarette drain was placed in the liver bed, leading to the stump of the cystic duct and brought out at the upper angle of the wound. The abdomen was closed in layers. The patient was returned to the ward in good condition.

The first two postoperative days were uneventful except for a moderate rise in temperature, associated with slight abdominal distention. The drain was removed on the third day. The wound healed per primam except at the site of drainage. On the fourth postoperative day, the patient was distressed by gradually increasing abdominal distention, accompanied by vomiting of small amounts of yellowish fluid, which was relieved by gastric lavage. She was passing flatus. From then on, the postoperative course became stormy and was marked by distention, vomiting and a gradual rise in temperature to 103.8°F. on the tenth day, pulse 120, respirations 28. Distention and vomiting increased, no flatus was being expelled and, in spite of everything that could be done, she continued to go downhill and died on the twelfth postoperative day, with a clinical diagnosis of paralytic ileus. An autopsy was requested, but refused.

FIG. 5. Preoperative roentgenological genito-urologic study, showing the magenblasse on the right side.

FIG. 6. Gastric roentgenogram showing transposition of the stomach and duodenum with the cardiac shadow in the left chest.

Pathologic Report of Gallbladder. Gross: The specimen was 11 cm. long, had a glistening serosa and contained thin bile. The wall was delicate. The inner aspect presented a typical bile-stained, intact mucosa. Microscopically, the section showed mucosal folds, lined by columnar epithelium and muscularis characteristic of the gallbladder.

The patient's demise precluded our intentions to investigate her intestinal anomaly and all our efforts to obtain a postmortem examination in order to elaborate upon our operative findings, were unavailing. We made a search

into the patient's past history and located her previous hospital record at the Jewish Hospital, Brooklyn, New York, from which the following pertinent data were extracted.

She had been admitted, October 30, 1931, with a clinical diagnosis of chronic cholecystitis. Subsequent examination revealed a mass in the epigastrium and a tentative diagnosis of neoplasm of the stomach or transverse colon was made. A gastrointestinal series (No. 79,953), taken November 7, 1931, was reported as follows: "The stomach is transposed. It is J-shaped and considerably ptosed, without evidence of intrinsic disease. The pyloroduodenal region is normal. The large bowel rests entirely in the right abdomen and the sigmoid extends well up on the right, probably beneath the diaphragm. Aside from the anatomic abnormality, no pathology is observed." (Figs. 6 and 7.)

An attempt to locate the liver was made by cholecystographic visualization (No. 80,121), November 11, 1931. "The gallbladder was visualized by means of a radiopaque dye and was found to be situated on the left side. There is a constriction in the region of the fundus noted on three films, suggestive of the presence of pericholecystic adhesions. The organ is completely empty at the 36-hour study. There is no radiographic evidence of a concretion in this region." Roentgenologic Diagnosis: Situs inversus of the liver.

The operative findings were corroborative of these roentgenologic reports. Confirmation of our clinical localization of the heart being in its proper position was demonstrable by a chest roentgenogram (No. 80,222, November 11, 1931) the report of which showed "the heart is not transposed." She was discharged with a diagnosis of transposition of the abdominal viscera.

DISCUSSION

The accuracy of the topographic diagnosis of abdominal diseases depends upon the assumption that the viscera occupy their normal position. But this is not always the case. All the abdominal viscera are liable, in more or less degree, to displacements, some of which date from birth, while others are acquired in later life.

The surgical importance of abnormal situation of abdominal portions of the alimentary tract requires little comment. It is of importance to the correct diagnosis of abdominal pathology. Thus, if left-

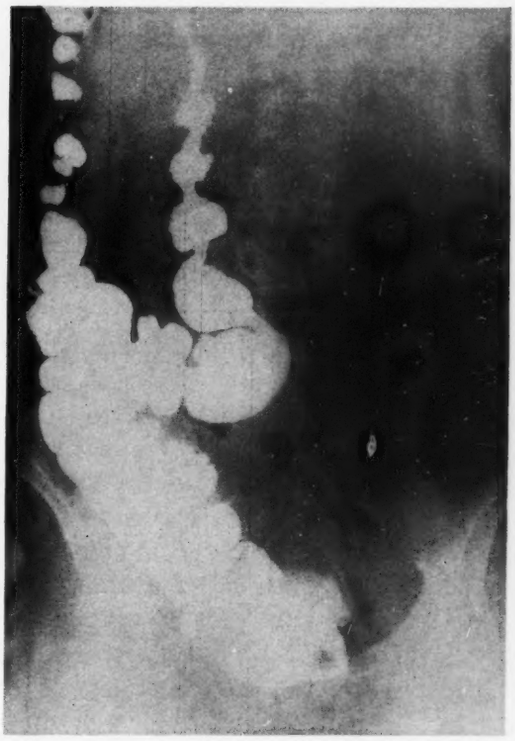


Fig. 7. Roentgenogram of the colon showing the cecum and appendix in their normal locations on the right side of the abdomen.

sided appendicitis has not been considered, disasterous consequences may result, while a normally situated organ would have been removed by timely operation. The same may be said of the gallbladder, although malposition of this viscus is rare in comparison. Failure to recognize the nature and characteristic features of these misplacements may lead to grave errors in procedure, or to injurious prolongation of the operation, or even its abandonment.

In surgery of infants, the condition acquires an especial significance, owing to the difficulties of abdominal diagnosis by exploratory celiotomy, and the probability of pathologic consequences of maldevelopments is greatest in them.

In exploratory operations upon the alimentary tract, it is important that abnormal dispositions of the viscera be recognized and further search made in

order to become oriented properly. Thus, in operations designed to apply to a particular portion of intestine, as in gastrojejunostomy, recognition of anatomic abnormalities is of great importance.

We believe an appeal should be made to the surgeon to take cognizance of the organs in the chest cavity in his physical examination as well as to those in the abdomen, for the discovery of a dexicardia may sometimes be associated with a situs inversus, thereby saving the surgeon from an embarrassing position and a state of chaos at the operating table. It is our belief that when an abnormality of the abdominal viscera is discovered, the examining physician should relate his findings to the patient and supply him with a detailed report of his examination. In the event that the patient should require subsequent treatment elsewhere of a surgical nature, at which time a complete roentgenologic survey of the abdominal viscera might not be feasible, the surgeon, having this record of the previous findings on hand, would be guided by this information in his diagnosis and operative procedure.

SUMMARY

1. Heterotaxy or congenital transposition of the internal organs does not constitute an exceptional anomaly, while segmental hetarotaxy is relatively rare.

2. Normal embryologic development of the primitive alimentary canal, with emphasis on the foregut, is briefly reviewed.

3. The pathologic consequences of anomalies of the alimentary tract are discussed as to their relative frequency, embryologic origin and surgical significance.

4. A case of segmental abdominal heterotaxy with multilobular spleen and a Riedel's lobe of the transposed right lobe of the liver is reported.

The authors wish to express their appreciation to Dr. Milton Wasch, attending radiologist at the Jewish Hospital, Brooklyn, New York, for his courtesy in permitting the use of his roentgenograms (Figs. 6 and 7) for reproduction and to Dr. John E. Jennings for his invaluable assistance and continued interest in the preparation of this communication.

REFERENCES

1. Bible. Exodus, 29: 17.
2. Ibid. Exodus, 29: 13 and Leviticus, 3: 3.
3. New Standard Bible Dictionary. P. 184. New York, 1926. Funk & Wagnalls.
4. Bible. Ezekiel, 21: 21.
5. Ibid. Deuteronomy, 18: 10–12.
6. Encyclopedia Brittanica. 11th ed., vol. 8.
7. Dott, Norman M. Anomalies of intestinal rotation. *Brit. J. Surg.*, 11: 251, 1923.
8. Risel, W. Die Literatur den partiellen Situs inversus der Bauchorgane. *Centralbl. f. allg. Path. u. path. Anat.*, 20, 673–731, 1909.
9. Soleil, G. Essai de classification des vices de l'evolution embryologique viscerale. Interversions et Heterotaxies. *Supplement Radiol. de la Gaz. méd. de France*, 44: 264–272 and 316–324, 1937.
10. Fraikin, Burill, et Noblet. Un cas d'inversion gastrohepatique (sans dextrocardie). *Bull. et mém. Soc. de radiol. méd. de France*, 14: 141–143, 1926.
11. Girod, Renee et Sarasin, Raymond. Situs inversus abdominal partiel avec fausse dextr-colie. *Ann. d'anat. path.*, 9: 838–840, 1932.
12. Meisels, Emil. Torsion des Magens. *Acta radiol.*, 363–367, 1925.
13. Weiss, K. Fortschrift auf dem Gebieber der Roentgen. 1923.
14. Serre, Antoine E. R. Recherches d'anatomié transcendants et pathologique (Theorie des formations et des déformations organiques). Paris, 1832. Bailliere.
15. Cockayne, E. A. The genetics of transposition of the viscera. *Quart. J. Med.*, 7: 479–493, 1938.
16. Martinez, Ezequiel A. Sindrome oclusivo, con inversion visceral y bazos supernumerarios. *Rev. méd. peruana*, 6: 1–2, 1934.
17. Kartegener, M. *Beitr. z. Klin. d. Tuberk.*, 83: 489, 1933.
18. Huntington, George S. The Anatomy of the Human Peritoneum and Abdominal Cavity. Philadelphia, 1903. Lea Bros. & Co.
19. Bailey, Frederick R. and Miller, Adam M. Textbook of Embryology. 5th ed. New York, 1929. Wm. Wood.
20. Arey. Developmental Anatomy. Philadelphia, 1937. Wm. B. Saunders Co.

SARCOMA DEVELOPING IN AN OLD BURN SCAR*

RICHARD M. FLEMING, M.D. AND PHILLIP R. REZEK, M.D.
Attending Surgeon, Jackson Memorial Hospital Pathologist to Jackson Memorial Hospital
MIAMI, FLORIDA

THE relation of trauma to tumor formation has been frequently discussed in considering the etiology of neoplastic diseases and numerous cases are on record citing this causal relationship. Although there appears to be firm ground for accepting this relationship clinically, we have little scientific evidence for this assumption. Hausemann insists that there is no scientific explanation for the development of neoplasm following acute trauma. Ramm, in speaking of sarcoma specifically, holds a similar opinion, although he admits the probability of trauma-tumor sequence from a histological point of view. The great difficulty in proving this relationship lies in our inability to prove the causa generis of malignancy, the frequently long latent period between trauma and tumor formation, and the fact that although accidents and trauma are very common, cancer follows in an infinitely small proportion of these cases.

Since this is true, we naturally ask why should cancer follow certain injuries while most trauma does not result in tumor formation. In answer to this question Fenster states that there are only two known biological procedures leading to tumor formation with any degree of certainty, namely, embryological and regenerative processes of growth and repair. He further states that it is generally recognized that most tumors have their origin in the so-called embryological anlage—the "germ" of the tumor; nevertheless, it appears that some tumors arise from an acquired germ anlage (as for example those originating in scars). At any rate every tumor has its origin in a germinal anlage; a fully matured cell of the body is not transformed into a tumor cell, and neither does the reverse process occur.

The acquired "germ" anlage is important in demonstrating the connection between trauma and tumor for it is based on a repeatedly disturbed regenerative process following primary tissue alteration. The factor of predisposition to tumor formation is an important if little understood quantity, and may be either general or local in nature. This, too, may be congenital, but occasionally is an acquired property.

Cancer developing in scars is well known and comprehensive reports and discussions have been contributed by many authors. A large series of cases of burn scar cancers have been reported by E. F. Neves, of Kashmir, India, smaller series being recorded by Roffo and Gandolfo, of Buenos Aires, and Treves and Pack, of New York City. Ewing's postulate for burn scar cancers, quoted by the latter authors, still stands as the measuring rod for this relationship:

"a. Incontrovertible evidence of burn as shown by the wound or resultant scar.

"b. The law of localities which purports that the cancer must originate within the boundaries of the burned area.

"c. The absence of any precursory or similar neoplasm on the site of the burn prior to the development of cancer.

"d. The histological variety of the cancer must be compatible with the tissue found in thermal wounds and scars, e.g., squamous cell carcinoma in the majority of instances and basal cell occasionally in superficial burns.

"e. The interval of time between the date of burning and the onset of cancer

* From the Tumor Clinic and Department of Pathology of the Jackson Memorial Hospital, Miami, Florida.

must be proper (more important for single acute trauma than for burns)."

According to Roffo and Gandolfo, the development of cancer in a burn scar is the result of isolation of epithelial cell "nests" subsequent to scarring. These remain dormant until certain irritating processes occur, such as trauma, endocrinological influences, etc., when after repeated stimulation neoplasm occurs. Lumiere, in discussing cancer as a cicatricial disease, states that nearly all skin cancers develop on scars and that a scar could be discovered as the basis for every case of skin cancer if looked for carefully. Only a few scars develop cancer, however, and these result under the following circumstances: (a) Prolonged healing of the wound; (b) old scars (twenty to thirty years); (c) secondary trauma to the scar; (d) humoral predisposition. Chronic irritation or infection of a scar results in repeated destruction and reproduction of epithelial cells. These cells finally acquire the special capacity for reproduction without the aid of an outside stimulus and growth becomes unrestrained.

FIG. 1. Photograph showing tumor of posterior surface of left thigh and benign ulceration of posterior surface of right thigh. Note dense scar tissue with contracture over right popliteal region.

Neves, in speaking of Kangri burn cancers specifically, stated in a personal communication to one of the authors (R. M. F.) that he was inclined to regard the heat waves rather than the products of combustion as the exciting cause of cancer in these cases. This brings heat waves into line with *x*-rays, etc., further along the spectrum, as a cancer producing factor.

Leriche believes that sclerosis of the vessels of the skin is necessary for the development of skin cancer. Winkler emphasizes the importance of the variation between cells and cell groups in their ability or inherent predisposition to become neoplastic. Hoffman points out that certain irritations prepare the cell for the development of cancer by maladjustment of tissue behavior; when an endogenous factor as above is combined with this, cancer then develops.

The type of cancer developing in a scar is predominantly epithelioma, and of the epitheliomas, squamous cell grade I or II is the usual histological picture. Treves and Pack reported only six basal cell carcinomas in a series of twenty-eight burn scar cancers, and of this number three were classified under "acute" wound cancer, that is, developing less than a year after the accident. These authors believe that basal cell carcinoma is more likely to develop early after superficial burns which spare the hair follicles and sweat glands, as in burns from hot solids. However, a divergence of opinion is expressed by Stauffer, who believes that the abnormally early appearance of cancer following a burn may be related to the existence of a precancerous condition of the affected area prior to injury. He cites instances in which this has occurred, and subsequent examination revealed precancerous conditions of other areas of the skin, such as senile keratoses, leukoplakia, etc.

Sarcoma following injuries is well known although infrequent. Sarcoma developing on scars is rarer still, except that type originating on old lupus scars. In none of the series of burn scar cancers reported was sarcoma mentioned. Neves knows of no case in his experience with thousands of burn scar cancers in which sarcoma developed. Most of the reported cases of sarcoma in scars has followed war wound injuries. Ramm has examined many reported cases and finds that most of them do not survive critical survey. This author suggests that the same factors which tend to produce carcinoma in scars are probably responsible for the development of sarcoma: namely, irritation from thermal, chemical, mechanical or infectious sources. Since sarcoma is a neoplasm of the cells of mesenchymal tissue origin, the results of such irritation or other influence applied to these cells will cause an imitation of the immature cells of connective tissue. As Bosnajkovic traces the process, scars subjected to repeated irritations resulting in constant destruction and regeneration of cells may become the site of benign proliferation of the connective tissue. This may take the form of a keloid or fibroma. In the beginning it is often difficult, even histologically, to distinguish between benign connective tissue proliferation and early sarcomatous transformation. An irritation which under ordinary conditions would be expected to produce a benign proliferation might produce sarcomatous transformation under certain circumstances. This may occur when the tissue in question contains misplaced embryonal cells (theory of Cohnheim and Berman), or an area transformed by a postembryonal mechanism to special susceptibility (Krompecher). Such an irri-

Fig. 2. Photograph shows extent of scarring which completely encircles both thighs.

tation may transform cells into a labile stage, sensitizing them to further stimulus. If this irritation is prolonged, autonomous proliferation with loss of restraint occurs and sarcoma develops (Borst).

FIG. 3. Photograph shows extent of endotherm excision. Muscle fibers can be seen in deeper portions of the wound.

It is of great interest that so few of the scar cancers reported are sarcomas. Why this should be is not altogether clear although it is fair to assume that the epidermis is subjected to more trauma than the connective tissue and, therefore, must undergo the process of repair much more often than the deeper layers of the epithelium and subcutaneous tissues. Whatever the reason, sarcoma developing in burn scars must be quite rare as we were unable to find any reported case, verified histologically, in our search of the literature. It is true that certain articles dealing with trauma and tumor were not accessible to us and it is possible that these articles might cite such cases. Since preparing this paper two other sarcomas developing in the skin following trauma have been seen in our department.

The following case is reported in detail because of the unusual histological picture of sarcoma developing in a burn scar:

CASE REPORT

E. W., fifty-four years of age, a white married male, was seen in consultation with Dr. A. G. Levin on May 15, 1939, because of recurrent ulcerations and tumor formation in old scars of both thighs. The patient had fallen in a bonfire forty-nine years previously at the age of five years and sustained severe burns of both thighs, anteriorly and posteriorly, as well as the posterior surface of both legs. He was treated by tub baths and traction for nine months with healing, by scar formation, taking place very slowly over a period of several years. Pinch grafts were applied over the knees only. Apparently the posterior surfaces of the thighs were burned most extensively, as healing was never complete; here heavy dense scarring occurred with recurrent ulcerations and abortive attempts at healing. The ulcerations on the right thigh became so painful and irritated that in 1914 the patient consulted a doctor who applied pinch grafts. This thigh finally healed completely by 1926 and remained healed for twelve years.

The lesion on the left thigh has never been completely healed at any time but has shown tendencies to improve rapidly for a short time only to break down and ulcerate widely.

In September, 1938, (eight months prior to this first visit) the patient went to Pikes' Peak where he experienced a severe sunburn of the thighs with vesicle formation. Following this the right thigh again became ulcerated in several areas. At this time the ulcer on the dorsum of the left thigh began to enlarge and tissue proliferated above the skin level. This grew steadily until the tumor reached the size of "half a tennis ball."

Examination at this time revealed no pertinent findings other than the lesions of the thighs. There were no palpable nodes. There was diffuse scarring of both thighs involving the entire circumference. However, the posterior surface of both thighs presented an extremely thickened, indurated, reddened area of scar tissue extending from below the gluteal

crease to the upper popliteal region which showed numerous ulcerated areas with secondary infection. On the left thigh, in the center of the ulcerated region, was a tumor mass measuring about 3 by 4 cm. and projecting 2 cm. There was a dense contraction over the right popliteal space which prevented extension of the right leg.

Fig. 4. Photograph six months following first graft. Thick split grafts of posterior surfaces of both thighs and right popliteal space. Note minimal skin changes over buttocks despite the fact that the same donor site was used for all three grafts at different times.

Laboratory findings were normal and the chest *x*-ray was negative.

Biopsy of the tumor of the left thigh was done on May 22, 1939, and revealed a sarcomatous process.

Operation was then performed by one of us (R. M. F.) on May 27, 1939, under spinal anesthesia. With the cutting current of the endotherm, wide excision of the entire thickened area on the dorsum of the left thigh was done, the excision being carried down to the fascia investing the muscles of the thigh. In some areas, especially along the medial border, the scar tissue was so intimately associated with the deep fascia that it was necessary to sacrifice the muscular fascia. An area 15 cm. in width by 17 cm. in length was excised. A biopsy was taken from the ulceration of the right thigh. A "Z" plastic was attempted in the right popliteal region but the tissue was so dense and avascular that it was impossible to approximate the triangles after undermining was done, and a defect was left over the popliteal space to be closed later with full thickness skin graft.

Pathological Examination. The specimen consisted of a piece of skin measuring about 10 by 15 cm. in diameter. A belt of normal skin measuring about 4 cm. in width surrounded an elevated area which was firm in consistency, presenting an irregular surface. The cut surface showed a grayish-white tumor tissue invading the subcutaneous fat tissue.

Sections showed neoplastic cell tissue which consisted of spindle cells differing markedly in size, form, shape and color. There were large

numbers of mitoses noted, and an impaction of the vessels. Secondary degenerations in form of hyalinization and necrosis were also noted.

FIG. 5. Excised tumor. Grayish-white nodules in the star-like scar.

An inflammatory reaction was present which consisted of leukocytes and lymphocytes. Diagnosis: Spindle cell sarcoma.

The wound was allowed to granulate to the skin level and the patient returned to the hospital on July 7, 1939, for skin grafting. The previously excised area in the posterior surface of the left thigh left a defect 15 cm. in length by 12 cm. wide. The surface was covered with clean, healthy, granulation tissue. In the right popliteal space, at the site of the previous "Z" incision for release of contractures, the margins of the wound had sloughed away and a defect 6.8 cm. in length by 3.3 cm. in width remained. This was covered with a healthy, granulating surface. The right leg could now be fully extended.

The granulating surface was shaved away with a sharp knife and the margins of the wound undermined about 3 or 4 mm. The defect was outlined with a rubber tissue dam and transferred to the skin of the buttock where thick split grafts were removed with the Blair-Brown skin suction apparatus and transferred to the defect. The graft was sutured about the margins with interrupted sutures of black silk No. 7. A sponge rubber pressure dressing was applied. The defect in the right popliteal area was similarly treated and multiple partial thickness skin grafts were applied and sutured in place. A moist sponge pressure dressing was then applied.

Only a small portion of the margins of the grafts showed any evidence of necrosis and these areas epithelialized rapidly after the necrotic tissue was removed. By August 30, 1939, the entire grafted area had the appearance of normal pliable full thickness skin and there was no evidence of disease.

A biopsy of the ulceration of the right thigh revealed no evidence of malignancy. However, excision of the entire ulcerated area was deemed advisable as a prophylactic measure. This was done on the other thigh. This graft was similarly successful.

On March 11, 1940, the patient returned for a routine follow-up at which time the left thigh showed a completely healed normal appearing skin graft. The right thigh was likewise completely healed, only a small area at the lateral border being covered with a superficial crust. However, the patient stated that three weeks previously he first noticed a painless lump in the left groin which grew rapidly to the size of a hens egg almost overnight. It had remained stationary since that time. Examination showed a nodular mass in the left inguinal region with several surrounding smaller masses. Extending directly above this was a still larger fixed intra-abdominal mass about 3 by 6 cm., apparently fixed to the lateral pelvic wall.

A biopsy of the inguinal mass was taken. Sections of the gland showed the entire gland to be completely replaced by very poorly differentiated neoplastic tissue. Most of the cells were arranged in whorl-like forms. The nuclei were either spindle or ovoid. They invaded the walls of the vessels, and a tremendous number of neoplastic mitoses as well as giant cells, were noted. In other areas,

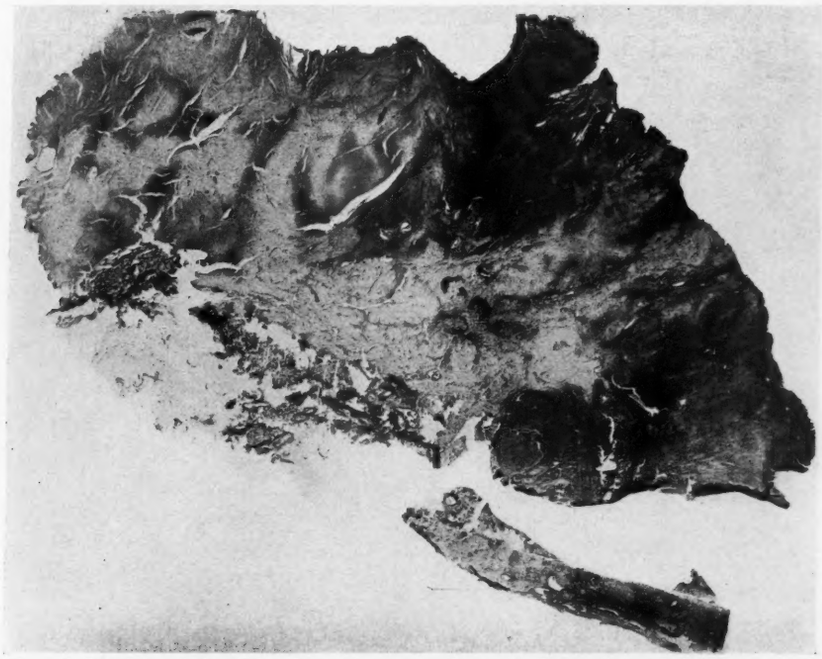


Fig. 6. Section of the skin through scar and tumor formation. Epithelium and cutis partly replaced by dense tumor infiltration, low power.

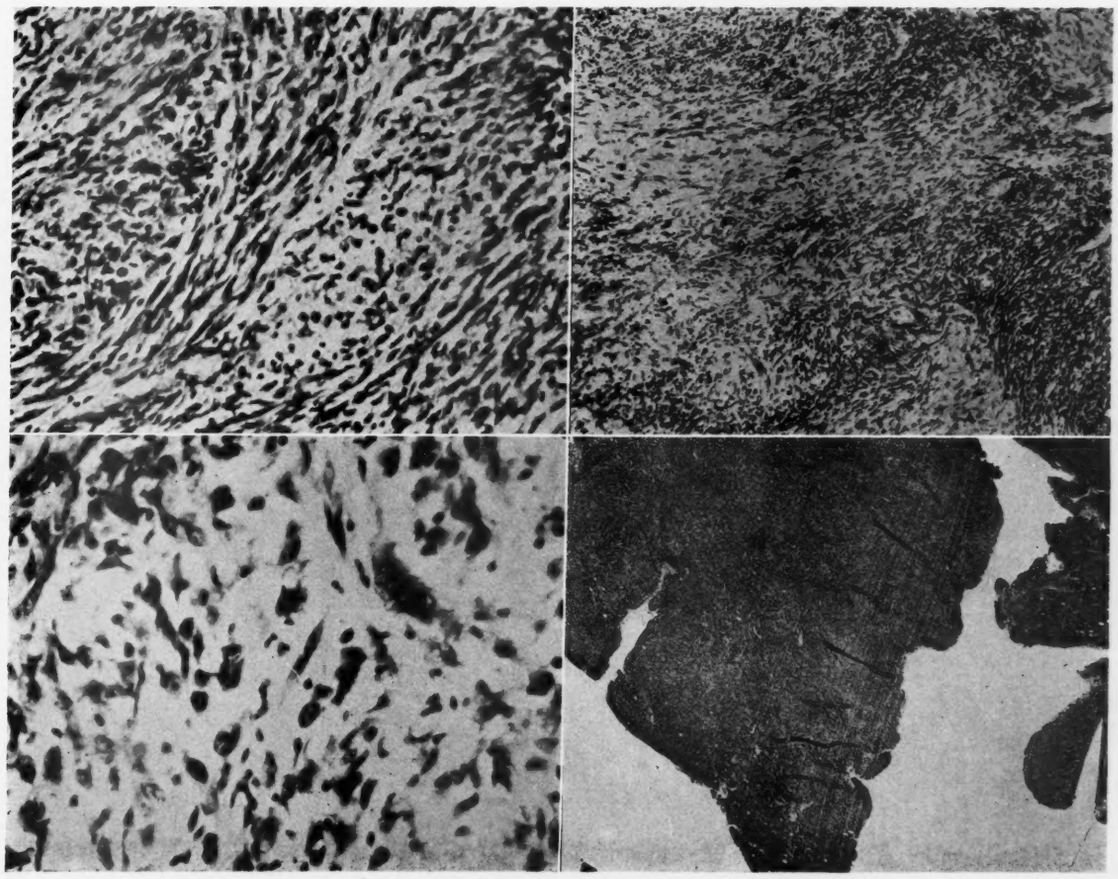


Fig. 7. Superficial layers of tumor tissue, medium power; spindle cells. Cells differ in size, form and shape.
Fig. 8. Deeper layers show the tumor more edematous in character. Some myxomatous cell forms are present.
Fig. 9. High power of deep layer of tumor; low grade of maturity, giant cells.
Fig. 10. Section of the inguinal lymph gland, low power. Entire gland practically completely replaced by tumor tissue.

however, these neoplastic cells were so poorly differentiated, and showed such an unspecific arrangement, that the sarcomatous character

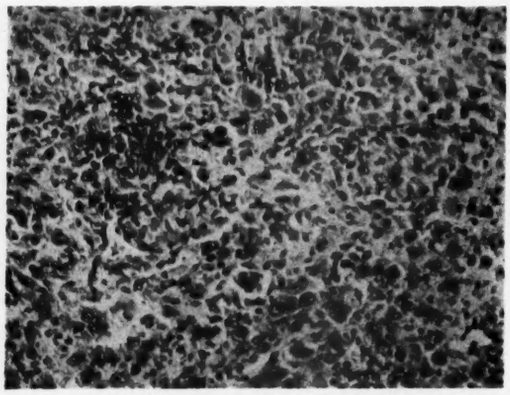


FIG. 11. Section of inguinal lymph gland, high power; cells of rather low grade of maturity; marked difference in size, form and shape; giant cells and mitoses.

was even doubtful, although the diagnosis of sarcoma was sure due to the findings in other parts of the slide. Diagnosis: Metastases of sarcoma in a lymph gland with very poor differentiation, and a high degree of anaplasia.

He was immediately referred to Dr. Levin for *x*-ray therapy but the patient deferred this until April 12, 1940. At this time the examination was the same as at the previous follow-up.

Following an intensive course of radiation to the inguinal and femoral regions and lower left abdominal quadrant, there was prompt regression of the masses.

By July, 1940, the skin reaction from *x*-ray had completely subsided and the patient had no complaints. There were no masses palpable in either the abdomen or inguinofemoral areas. No evidence of disease was found. *X*-ray of the chest was again negative for metastases.

The patient remained symptom-free until the latter part of September, 1940, at which time he complained of a slight pain in the right chest of several days' duration. Examination revealed a few râles in the lower axillary region. Within thirty days a friction rub appeared in this region and later a nonproductive cough, dyspnea and low grade fever developed. At this time a recurrence of the mass was noted in the left subinguinal region which gradually enlarged until the time of his death.

He required repeated thoracenteses to relieve the dyspnea associated with a bloody pleural effusion of the right pleural cavity. About two weeks prior to death he developed symptoms of partial intestinal obstruction which condition was one of the factors in the causation of his death. It was believed that the probable extensive involvement of the retroperitoneal nodes, as well as the abdominal viscera, rendered surgical aid unfeasible. The patient expired on January 8, 1941.

Summary of Chief Findings at Autopsy. Skin: There was a small metastasis to the anterolateral aspect of the left thigh and a smaller metastasis to the right scapular region. Peritoneal Cavity: A moderate amount of bloody fluid was present in the peritoneal cavity. Diffuse irregular nodules were scattered over the entire peritoneal surface and omentum. Gastrointestinal Tract: The gastrointestinal tract showed compression of the splenic flexure of the colon due to numerous enlarged lymph glands in the mesentery. There were multiple areas of adhesions between the loops of small bowel, its mesentery, and the peritoneum, producing many partially obstructed areas. Liver: The liver revealed multiple nodular metastases. Spleen, Pancreas, Kidneys and Adrenals: The spleen, pancreas, kidneys, as well as the adrenals, showed no evidence of metastases. Sex Organs: With the exception of a moderate prostatic hypertrophy, the sex organs were without evidence of pathology. Thoracic Cavity: The thoracic cavity showed a bloody pleural effusion on the right. The pleura on this side showed thickening of both layers and partial replacement by tumor masses. The right lung was grossly suspicious of metastases. The heart showed a moderate coronary sclerosis. Histological Sections: In none of the sections taken from the autopsy material was the histological structure identical with that of the primary tumor. Nowhere was the spindle cell character of the primary tumor observed. All of the sections showed more similarity to the picture seen in the section from the biopsy of the lymph-node, viz.; very poorly differentiated neoplastic cells with numerous mitoses and giant cells.

DISCUSSION

This case illustrates the importance of early proper care of burns including skin grafting. It also demonstrates the inadequacy of pinch grafts over large areas or over areas subject to trauma.

It is regrettable that an inguinal node dissection was not done at the time of

excision of the primary lesion; this might have prevented recurrence. Since, however, the tumor was quite vascular and sarcomas metastasize typically by the blood stream, we elected to omit dissection.

It is interesting to note that a relatively mature fibrosarcoma produced rapidly growing anaplastic metastases. This accounts for the excellent though temporary response to radiation therapy.

SUMMARY

A case of fibrosarcoma developing on an old ulceration in a burn scar of forty-nine years' duration, is reported.

The tumor was treated by wide endotherm excision followed by thick split skin grafts. The patient remained completely well for nine months, before developing anaplastic metastases to the inguinal and iliac nodes. The metastases were temporarily controlled by radiation therapy, and the patient showed no evidence of disease for four months after treatment. Diffuse general metastases occurred after this period, however, and the patient succumbed nineteen months following his original operation.

Carcinoma developing in burn scars is not uncommon, but sarcoma is extremely rare as we were unable to find another reported case, verified histologically.

REFERENCES

1. Borst. Quoted by Ramm.[12]
2. Bosnajkovic, S. Development of sarcomas. *Dermat. Ztschr.*, July, 1938.
3. Cohnheim and Berman. Quoted by Bosnajkovic.
4. Fenster, E. Tumor und Unfall. Enke Stuttgart, 1937.
5. Hausemann. *Ztschr. f. Krebsforsch.*, 15: 432, 1916.
6. Hoffman, E. *Wien. klin. Wchnschr.*, 51: 21, 1938.
7. Krompecher. Quoted by Ramm and Bosnajkovic.
8. Leriche. Quoted by Lumiere.
9. Lumiere, A. Cancer as a cicatricial disease. *Hippokrates*, 2: 306–311, 1929.
10. Neves, E. F. Personal communication to author.
11. Roffo, A. H. and Gandolfo, A. Cancer developing on old scars of burns—report of 25 cases observed at Institute of Experimental Medicine in Buenos Aires. *Prensa méd. argent.*, 21: 351, 1934.
12. Ramm, C. Relation between sarcoma and trauma. *Monatschr. f. Krebsbekämpf.*, Sept. 1933.
13. Stauffer, H. Cancer following burns. *Ztschr. f. Krebsforsch.*, 28: 418–430, 1929.
14. Treves, N. and Pack, G. T. Development of cancer in burn scars. *Surg., Gynec. & Obst.*, Dec., 1930.
15. Winkler, K. Jadassohn Handbuch d. Haut and Geschlechts Krakheit. V. xii, p. 720.

MARJOLIN'S ULCER*

REPORT OF A CASE

HAROLD R. BROWNE, M.D.
Courtesy Staff on Plastic Surgery, Albany Hospital, Albany
DELMAR, NEW YORK

WITH military preparedness now under way our attention is directed toward the problems of military reconstructive surgery and how best to cope with them. One of these problems is the question of burns. It is here that we find a vast field for prophylactic surgery. During the first World War many severe burns, including those from explosives as well as aviators burns, were treated. It would be expected that such types of burns would be considerably more numerous in this present war. We may still see, in our time, further complications arising from the burns of the last war, as it has been demonstrated that the small percentage which shows degenerative changes on through to malignancy occurs from four months to thirty-two and one-half years later.

In 1828, Marjolin described the pathologic picture of malignancy occurring in burn scars. For many years it was called Marjolin's ulcer. The original description as it appeared in "Dictionnaire de Medecine pratique" is as follows: "La surface de ces ulcères est formée par un tissu composé d'un grand nombre de villosités coniques, d'une texture dense, serrée, trés rapprochées les unes des autres, représentant en quelque sorte un velours de laine groosier. Ces ulcérations laissent suinter en petite quantité un fluide visqueux presque incolore, fétide, qui en se desséchant forme une croûte épaisse, dure, grisâtre, trés adhérente. Ils sont peu douloureux au même indolents et susceptibles de prendre une grande étendue."

These ulcers may remain for a great many years as simple chronic ulcers before the insidious malignant change occurs. This usually begins at a portion of the margin and spreads slowly and progressively though usually only a portion is malignant, the remainder being non-malignant. The edges are raised and indurated, the center may be filled with granulations, some healthy, some sloughing and grayish in color. They exude a thick colorous viscid fluid which upon drying forms a thin crust which bleeds when removed. The odor is usually foul. There is evidence of healing in spots where the cancerous tissue has sloughed to a normal base. One important feature of these ulcers is that they are painful and the pain is described by Paget as "hot, scalding and of a darting character." By this time the floor of the ulcer and margins have become greatly indurated and the floor appears wavy, like a velvet plush. The lymph channels are blocked by the induration and metastasis occurs late. The age of the scar is more important than the age of the patient.

The prevention of burns is beyond our power but after the burn has once been received, much can be done to eliminate the inevitable sequellae. The primary treatment is of paramount importance in avoiding infection and thus promoting a good granulating surface, most desirable for skin grafting.

It would appear safer to clean up any infection which usually exists, before exploring the depth and nature of the growth. A biopsy can then be safely done and a thorough excision accomplished to a safe depth and width, preparatory to skin grafting.

* Read before The Society of Plastic and Reconstructive Surgery at Chicago, October, 1940.

Treves and Pack collected over a twelve-year period 1,091 patients with epidermoid carcinoma of the skin and 1,374 patients with basal cell carcinoma. In twenty-eight instances these carcinomatous growths developed on the basis of burn scars, new and ancient; twenty-one were epidermoid carcinomas and seven were basal cell carcinomas. From these figures they estimated that about 2 per cent of all epidermoid carcinomas and $\frac{3}{10}$ per cent of all basal cell carcinomas originate on the skin which has been subjected to thermal injuries of all types.

In 1902, DaCosta reported two cases of Marjolin's ulcer in which he spoke of this pathologic entity as a rare condition. Strauss described two of his cases in which *x*-ray and radium treatment probably played a factor in the carcinoma which developed in burn scars.

Attention is also called to the Kangri burn cancer of India which results from the wearing of small charcoal stoves under the loose garment of the natives. It is stated that forty-five operations annually are performed for this type of carcinoma alone. Similar to the Kangri burn is the Kairo burn cancer of the Japanese resulting also from the wearing of a small portable stove for body warmth.

From these cited statistics we observe that, although the cases are comparatively few as compared with burns as a whole, we are nevertheless dealing with a clinical entity which may lead to a disastrous termination if not recognized and dealt with properly.

As stated before, everything possible should be done to obtain a good granulating surface. Then, when conditions warrant, this surface should be covered with a suitable skin graft, thus eliminating the train of infection, fibrosis, thick unyielding avascular scar and contraction. Then comes a period of freedom of clinical symptoms only to be followed months or years later by repeated abrasions or irritation of the scar with poorer healing qualities each time, until the epithelial stimulation has been such that it now has reached neoplastic proportions.

It is indeed fortunate that this neoplasm is situated upon such a fibrous, avascular base. Because of this, metastasis to the regional lymph glands is very slow and late, and the chance of a cure is favorable. Conversely, when the neoplasm breaks through this avascular scar its growth is extremely rapid and usually proves fatal after two years.

X-ray has proved of some use in the preoperative treatment of the basal cell cancers but neither *x*-ray nor radium has any affect upon the squamous type.

The case under discussion should be of interest for the following reasons: first, because of the age of the patient and the length of time intervening between the reception of the burn and the inception of carcinomatous changes occurring in the scar—a period of some thirteen years; second, because of the similarity to Marjolin's ulcer both in the gross and microscopic; and third, because of the difficulties encountered over a period of years before the contractions were relieved, the infection was controlled, the skin grafts were applied and the patient was apparently cured. The report of the case follows:

CASE REPORT

In December, 1926, when K. N. L. was four years old he was playing with a flaming broom. The left pocket of his playsuit was nearly full of matches of the nonsafety type. These became ignited and caused a deep eschar over the left groin varying in density as it approached his left chest, part of the left arm to the elbow and down the left leg on its anterior and lateral aspects to the knee.

It was treated with oil and later on, with salt solution for nearly four months when pinch grafts were applied to the remaining granulating area. A curious fact is that these grafts were taken from both the father and the mother. The patient states that his father's graft would not take but that his mother's proved satisfactory. At least they "stemmed the tide" until epithelization intervened. *X*-ray treatments were given weekly for the

next thirteen months with the idea of softening the dense scar tissue.

No further treatment was needed until 1928 when contraction of the scar in the groin, plus the growth of the child, caused him to bend forward at an angle of sixty degrees in order to walk. At this time the dense scar in the groin and in the axillary fold was cross cut and undermined, and apparently allowed to granulate in. A cast with windows in for dressings was applied from the axilla to the knee. This cast was left on for some six months. After its removal, the legs of the patient appeared to be of equal length and the incisions appeared to be satisfactorily healed. Growth and contraction again took up the slack and by 1932 the patient was walking at an angle even greater than the earlier one. This time two full thickness grafts were applied, one taken from the anterior surface of the right thigh and the other from the good skin of the abdomen. One graft was applied to the area of the left lower quadrant and the other over the upper and inner third of the thigh. It is presumed that some of the scar was removed at this time. Part of one of these grafts was lost which necessitated a Thiersch graft to complete this operation.

Again in 1935 a "Z" plastic was preformed by this last surgeon to relieve a slight contraction in the groin.

The patient consulted me in 1938, at which time there was an ulcer about 4 cm. in diameter and 10 cm. below the trochanter with rather punched out margins. (Fig. 1.) There was some infection with a slight tendency to granulate in. After two months of applications of various kinds, the ulcer healed in a desultory manner, only to break down late in 1939, when the patient returned, this time with an ulcer twice its previous size located near the old site. The ulcer was punched out with a sloughing base, rounded edges piled up and undermined. Considerable infection was evident and a culture showed anerobic and aerobic hemolytic streptococcus and staphylococcus plus pyocaneus. Getting this under control was a genuine problem. The usual method for combating infection including the use of sulfanilamide were all tried. Results were best obtained by following the method of Meleney, namely, the application of zinc peroxide. One day the granulations would appear healthy; a few days later some of them would be in an unhealthy condition. The undermined edges were slowly breaking down in some areas while eivdences of healing occurred in others. The infection as a whole was receding; signs of epithelization were almost nil. A few deep pinch grafts were applied in the upper part of the ulcer which had now reached 6 by 10 cm. in size. The granulations were fairly clean and nearly all the grafts took with some impetus toward epithelization. However, some infection still remained.

FIG. 1. Shows the ulcer as it appeared in 1938. T-Trochanter. Ink lines mark out the abnormal tissue from the scar tissue. The two small marks show the triangular area which, more or less, was grafted successfully with deep pinch grafts in order to epithelize the ulcer and thus help combat the infection.

Early in February the granulations and base took on a different hue within the center of the large ulcer. The change occurred at the original site of the scar area which first broke down. It is *here* that the description of Marjolin's ulcer enters the picture: the grayish velvet plush, conical vellosities and crust accompanied by pain of a burning nature, bleeding, etc.

Again the patient was hospitalized in February, 1940. The area was Dakinized for a few days and then gently scrubbed with soap and water, as advocated by Blair, Brown and others, in order to rid it of pyocaneus. It was determined, and a culture substantiated the opinion, that a débridement with cautery would be safe. This was accomplished and time was bided until a thorough pathologic study could be made regarding the nature of the tissue and its extent. The pathologic report returned epidermoid carcinoma grades I and II. (Figs. 2 and 3.)

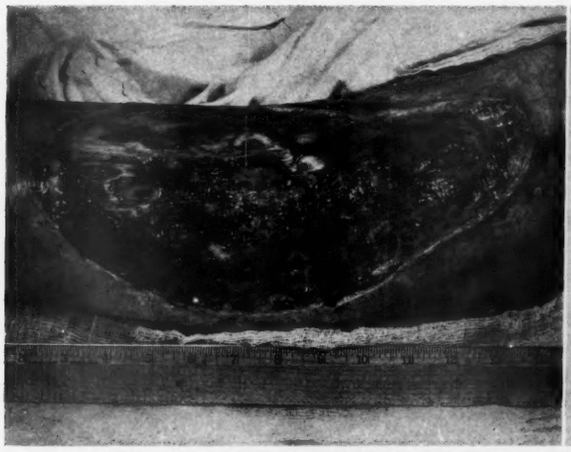


Fig. 2. Shows the area after the first débridement down to the fascia lata. The remaining tissue is composed of granulation interspersed with carcinoma.

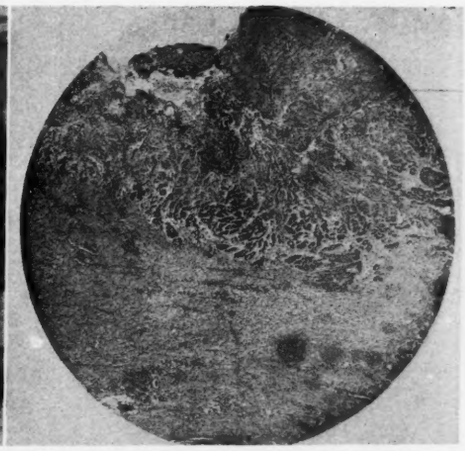


Fig. 3. Epidermoid carcinoma invading granulation tissue at the base of the old burn scar. None of the carcinoma was found to have gone completely through the fascia lata.

We had not gone sufficiently deep nor wide enough as all about the area the scar was still decidely thick. The skin ulcer this time was dissected *en masse* including the fascia lata down to the muscles. This tissue was sent to the laboratory where sections were cut out and the specimen was lettered and photographed as shown in Figure 4. As can be seen, the section was thoroughly gone over, and when the report came back negative for carcinoma we believed that a split skin graft could be applied with fair certainty of no recurrence since there was no adenopathy. (Fig. 5.) The base had a healthy layer of granulations over its entirety. With Padgett's dermatome, approximately three drums of skin .016 of an inch thick were cut from the right leg and right chest. This thickness, we believed, in a boy of seventeen should provide a good covering with fair certainty for a "take." The grafts were

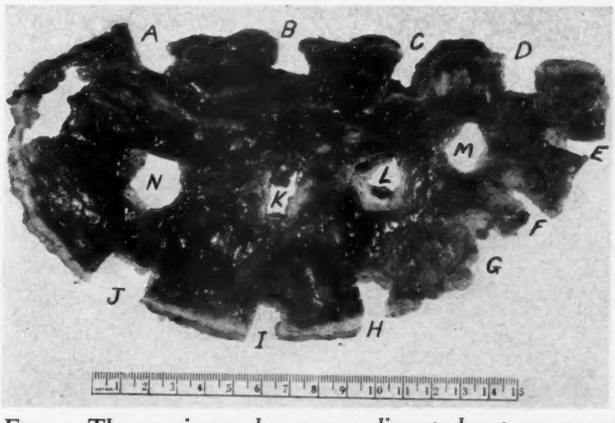


Fig. 4. The specimen shown was dissected out *en masse* down to the muscles. Areas which appeared suspicious of carcinoma were cut out and labeled so that should carcinoma be found in the deep layer the exact area could be determined.

sutured on with interrupted Deknatel No. C and left long on the edges. The separate grafts were overlapped and sutured. A few stab incisions were made for drainage. Three per cent xeroform gauze was cut to pattern and several layers were held in place by means of tying the long sutures across the graft. More gauze was smoothly applied and a Dakin's tube was incorporated in the dressing. This whole dressing was held in place with bandages and elastoplast. With this Dakin's tube the dressing was continuously irrigated with 3 per cent boric acid solution and was not disturbed for eight days. The stitches were then removed. The edges were painted with 5 per cent Gentian violet and redressed with zeroform gauze, etc., as before. The graft looked well except that at its upper pole where it was difficult to obtain pressure. Dakin's solution was used for three days, at the end of which time it was discovered that most of the tissue which looked doubtful previously, was saved, as is shown in Figure 6.

During this time the donor sites were covered with parresined gauze, 3 per cent xeroform ointment, gauze and elastoplast. They were again dressed at the end of a week and healed in from fifteen to twenty days, with no complications.

In the lower left quadrant *x*-ray telangiectases and scaling were beginning. It was noted that a slight contracture was developing in the left anterior axillary fold. In view of the previous experience it was decided that this tissue should be removed at a later date, thereby allowing the patient to get into better physical condition. In July of this year he returned to the hospital for what we hope is his final plastic repair. This time the *x*-ray telangiectases were removed and the axillary scar released and undermined. With the Padgett machine a section of skin, three by eight inches and .018 of an

FIG. 5.

FIG. 6.

FIG. 5. Shows the area after final débridement which is now covered with a healthy layer of granulations and is ready for grafting.

FIG. 6. Showing the area ten days after grafting with .016 of an inch split graft. The graft took in its entirety except at the upper pole where pressure was difficult to obtain. Most of this was saved by the prompt use of Dakin's solution.

inch thick, was taken again from the right leg, cut to pattern and inserted into this denuded area. The dressings were essentially the same as before and the result was a 100 per cent "take." Incidentally, there was microscopically a suspicion of carcinomatous changes, but since all scar tissue was deeply removed, I doubt if any concern regarding neoplastic recurrence is justified.

The patient can now stand erect. The scar tissue is replaced by a mobile, elastic, normally functioning skin which gives freedom over the area of the trochanter which heretofore was covered by a thick, inelastic, immobile and avascular tissue, a tissue which had all the prerequisites for the degeneration of scar tissue, irritation, infection and resultant neoplastic changes or Marjolin's ulcer. (Fig. 7.)

COMMENT

If our present day knowledge had been available in the beginning I am sure that this case would have been managed differently. As soon as the primary shock was under control and a granulating stage of the burn was reached, no doubt Thiersch grafts would have been applied, if only to check fluid loss in order to prevent infection and to promote epithelization. Undoubtedly, thicker grafts, by necessity of the contracting Thiersch grafts, should have been inserted here and there. The patient would have been spared the suffering during childhood plus the ultimate neoplastic results. Furthermore, changes in *x*-ray technic have now greatly removed the possibilities of overdosage.

For my patterns I have been using a heavy cotton flannel material used for padding under table cloths. This material will not shrink appreciably upon boiling and when placed directly upon the blood-stained recipient area, an exact replica can be cut out. A four spout Dakin's tube is used, connecting the two outside and the two inside tubes with a sufficient length of Penrose tubing to form loops of satisfactory size to cover the graft. Holes are burned in every quarter to one-half inch. This tubing is so pliable that when incorporated in the dressing no harmful pressure can be exerted upon the graft.

Fig. 7. Shows the final result after grafting. At the present time a year has elapsed with no recurrence of malignancy.

By this closed tube arrangement the dressing is kept moist (at eight drops a minute) regardless of the position of the patient or the location of the graft. In my opinion, careful attention to such details reaps its rewards in its final result.

REFERENCES

Brown, Byars and Blair. A study of ulcerations of the lower extremity and their repair with thick split skin graft. *Surg., Gynec. & Obst.*, 63: 338, 1936.

DaCosta, J. C. Carcinomatous changes in an area of chronic ulceration, or Marjolin's ulcer. *Ann. Surg.*, 37: 496–498, 1903.

Marjolin, J. N. Ulcère. Dictionnaire de Medicine Pratique. 2d ed., xxx, 10, 1846.

Strauss, A. Epitheliomas arising in scars. *Am. J. Surg.*, 7: 699–703, 1929.

Treves, Norman and Pack, George T. The development of cancer in burn scars. *Surg., Gynec. & Obst.*, 51: 749–751, 755, 763, 1930.

RIEDEL'S THYROIDITIS

A REVIEW AND REPORT OF TWO CASES

HENRY I. GOODMAN, M.D.
NEW YORK, NEW YORK

IN 1894, and again two years later, Riedel described before the International Congress of Surgery, a new pathological entity of the thyroid which created considerable interest. However, in 1864, Semple and in 1884, Bowlby had already described a case with clinical and pathological features very similar to those subsequently noted by Riedel. This disease has since been described also under the following nomenclature: Infiltrating Fibroma of the Thyroid (Bowlby), Eisenharte Strumitis (Riedel), Primary Canceriform Inflammation of the Thyroid (Berry), La Thyroiditis Ligneuse (Delore and Alamartine), and Benign Granuloma of the Thyroid (Ewing).

This varied nomenclature, though seemingly different, relates to a disease which is comparatively rare. Until 1926, thirty-three cases were reported by twenty-three authors and until July, 1939, we were able to find 141 cases which appeared to be typical cases of Riedel's strumitis. In this article, only cases which have established beyond a doubt the pathological picture, grossly and microscopically, have been accepted as typical of Riedel's strumitis. Cases reported as Hashimoto's disease have not been included for reasons which will be given later. From a study of the enclosed tables, it will be seen that there has been an increase in the number of cases reported in recent years due, no doubt, to the fact that more thyroidectomies have been performed and more complete pathological studies made. It is also interesting to note that regardless of geographical distribution there has not been a very great variation of the incidence. Inasmuch as this disease is so important in a consideration of the differential diagnosis and treatment between it, malignancy and Hashimoto's disease, its importance cannot be over emphasized. The average incidence in thyroidectomies of 0.2 per cent is sufficiently low to warrant a more recent review of the subject and the report of two new cases.

CASE REPORTS

E. A., age forty-six, a white female housewife, was first seen May 3, 1939. Her chief complaint was swelling of the neck for about two years. There were no other instances of goiter in the family. Except for her father dying of pulmonary tuberculosis, the family history was negative, and the past history was irrelevant.

For the past two years, the patient thought her health had been poor. She believed that she had had a goiter for two years, but the onset was so slow and gradual that she was not fully aware of its actual presence until relatively recently. At times, she had felt nervous and irritable. On occasion, she had noticed some palpitation, usually following some exertion. Recently, she began feeling a sense of weight and pressure in the neck and at the same time became aware that her goiter was extremely hard. Sometimes, she would have paroxysms of coughing lasting a short time. There was no dysphagia. The patient stated that she had lost fifteen to twenty pounds in weight during the past month.

At the physical examination the patient appeared to be considerably underweight. The examination of the neck revealed a fairly symmetrical enlargement of both lobes of the thyroid, measuring about 5 by 4 cm. The surface was smooth and the whole goiter moved easily on deglutition. There was no apparent fixation to surrounding structures. No glands were palpable. The most impressive feature of the examination was the stony hardness of the entire goiter. The clinical diagnosis was probably malignancy of the thyroid.

On May 11, 1939, the patient was operated upon under evipal and gas-oxygen anesthesia. At operation, the goiter was found to be so hard that it was only with the greatest difficulty that it was possible to place hemostats as the resection was proceeding. It was quickly realized that a classical thyroidectomy leaving the posterior capsule was technically impossible. Only about half of each lobe was, therefore, resected. There was little bleeding.

Pathological report: Macroscopic examination: The specimens labled "thyroid" measure 45 by 25 by 20 mm. and 35 by 20 by 20 mm. Their free surfaces are bosselated and upon cross section, greyish white and extremely hard homogeneous tissue is revealed.

Microscopic examination: The stained sections show that the thyroid tissue has been entirely replaced by an extensive fibrosis, in which numerous tubercles are present. These tubercles which consist of numerous giant cells and occasionally with epitheloid cells, though atypical in structure, excite the suspicion of a possible tuberculosis of the thyroid. The macroscopic characteristics of the specimen, however, do not support this diagnosis, but excite the suspicion that we are dealing here with a so-called "Riedel's Struma."

A search for a malignant process was made but resulted negatively.

Diagnosis: Riedel's Struma.

Slides were submitted to Dr. Paul Klemperer, pathologist to Mt. Sinai Hospital, New York City, for an opinion and he reported that although a tuberculous process cannot be eliminated with entire certainty, he feels reasonably sure that we are dealing with a "Riedel's Struma."

The postoperative course was uneventful. She was discharged on the seventh postoperative day. Primary union had taken place. On discharge, there still remained an area of hardness at the site of each lobe. On October 24, 1939, examination of the neck revealed no evidence of previously noted indurations. The patient feels much improved and was discharged.

S. M., age forty-two, a white female housewife, was first seen January 14, 1941. Her chief complaint was goiter; duration two and one-half months. There was no history of chronic illnesses or goiter in the family, and the past history was irrelevant.

About two and one-half months before admission the patient noticed that her neck was becoming a "little stiff" following a history of throat infection. She had had difficulty in swallowing for a short time and still felt a sensation of tightness in her neck. At times, she felt somewhat dyspneic. She did not cough. She had noticed a hard swelling in her neck in the region of the thyroid gland. This swelling had not increased appreciably. At times, her voice was a little hoarse. There was no tremor. Sometimes, she felt irritable, but otherwise considered herself to be in good health. Her present weight was 135 pounds which was the most she had ever weighed.

Physical examination revealed a patient well nourished who appeared very complacent. The examination of the neck revealed a stony hardness in both lobes of the thyroid. The right lobe was a little larger than the left which measured 5 by 3 cm. The surface of the goiter was smooth and there was no fixation to surrounding structures. The whole gland moved easily on deglutition. There were no palpably enlarged glands. Examination of the vocal cords revealed a lagging of the right cord. The clinical diagnosis was chronic thyroiditis secondary to nasopharyngial infection, possibly Riedel's thyroiditis.

On January 15, 1941, the patient was operated upon under gas-oxygen anesthesia. The thyroid was exposed through a collar incision with separation of the ribbon muscles in the midline. The capsule of the thyroid was considerably thickened, greyish in color and smooth as though covered with an organized exudate. Early evidence of fixation was apparent. Keeping in mind the possibility that this might be Riedel's thyroiditis, a classical resection was not attempted. Rather, a resection was done which completely exposed the trachea as a decompressive procedure. There was little bleeding. The wound was closed in anatomical order, leaving a small amount of drainage material on each side of the trachea.

Pathological report: Macroscopic examination: Specimen consists of two portions of tissue measuring about 3 by 4 cm. On cross section, it cuts firmly. The cut surface is homogeneous in appearance and greyish in color.

Microscopic examination: Sections of the portions of the thyroid gland show a marked overgrowth of fibrous connective tissue dividing the thyroid into islands. Throughout, there is an infiltration of plasma cells and lymphocytes.

Tubercle-like areas with giant cells are noted. These, however, do not indicate the presence of tuberculosis. No evidence of malignant changes are seen in the sections examined.

Diagnosis: Thyroiditis, Reidel's Struma.

Dr. F. W. Stewart of the Memorial Hospital is also in complete agreement with this diagnosis.

Her postoperative course was uneventful. She was discharged on the seventh postoperative day. Primary union had taken place. The patient states that she no longer has sensation of tightness in her neck. Basal metabolism taken two weeks after discharge was −21.

Author	No. Thyroidectomies	Riedel	Percentage
Scholffer	450	1	0.20
Riedel	1,064	3	0.37
Berry	500	1	0.6
Schultz	305	3	0.98
Smith and Clute	1,200	5	0.41
Enderlen	3,396	1	0.03
Jackson	2,000	1	0.05
Eberts	1,015	1	0.10
Frazier	1,551	4	0.26
Pemberton	12,219	34	0.28
Joll	5,650	10	0.50
Eisen	2,908	7	0.24
Graham	17,826	27	0.15
Joyce	1,060	5	0.47

The etiology is obscure. The disease has a strong predilection for the female sex, about a three to one ratio. It occurs in 60 per cent of cases between the fourth and fifth decades. The youngest reported case was found in a girl of four years, the oldest case in a man seventy-eight years old. In 30 per cent of the cases, there is a history of a pre-existing goiter. Focal infection has been stressed as a cause. Bohan mentions the teeth; pharynx and tonsils were suggested by Monod, Searls, and Meeker. Lues, at one time, was thought a probable etiological factor by Monod, Delore and Alamartine, and Kuettner. However, in none of the cases reviewed could lues be established as a factor. Tuberculosis was also prominently mentioned as a cause by Schloffer, Crotti and Plummer. This theory has also been abandoned. Meeker mentioned the possibility of a relationship between remnants of the postbronchial body and Riedel's disease. Meyers considers Riedel's disease as a chronic granulomatous type of chronic inflammation. In one of his cases, he noted a histological picture of plasma cells and eosinophiles similar to that seen in Hodgkin's disease, except for the absence of Steinberg cells Ewing, Schultz and Meeker also support this theory. Williamson and Pierce classify Riedel's disease as a lymphadenomatous goiter.

Pathologically, one or both lobes of the thyroid may be involved entirely or partially. The gland is "stony" hard and in earlier stages, pale pink and limited to the normal confines with few adhesions to surrounding structures. The surface of the gland is smooth and cuts like cartilage. The capsule is thickened. The normal lobulation may be lost. As the disease progresses, the process may extend in extreme cases from the bifurcation of the trachea to the base of the skull, enveloping the blood vessels and ribbon muscles into one diffuse mass (Monod, Berry). The trachea, at first deviated, becomes later a flattened structure resembling a scabbard. With this compression of the trachea, paralysis of one laryngeal nerve is not unusual. The esophagus is rarely involved. Because this process is apparently not infiltrative in character, no invasion of neighboring structures is noted. The lymphatic glands are not involved. No involvement of the sympathetic chain has been reported. With the exception of cases reported by Monod and Berry, observations agree that the skin remains uninvolved in Riedel's thyroiditis.

Microscopically, the characteristic features are those of a chronic inflammatory process with extensive replacement of thyroid tissue by fibrous tissue which appears to be slowly strangulating the remaining islands of thyroid tissue. This picture apparently represents the terminal rather than the initial stage of the disease. In earlier stages, an infiltration consisting of lymphocytes, plasma cells, neutrophiles

and eosinophiles, appears in the intralobar tissue. The infiltration then perforates the capsule and spreads into the surrounding tissue. Gradually this inflammatory infiltration is replaced by extensive proliferations of connective tissue. The process in Riedel's disease is unilateral in about 40 per cent of the cases; the mass is seldom larger than a goose's egg with muscle tissue usually adherent to the gland. The cut surface is dull white with areas of colloid containing tissue. Microscopically, diffuse lymphocytic infiltration is absent. In the parenchyma, there are no traces of epithelium or colloid, except near the periphery. Beyond the fibrotic areas may be seen colloid containing vesicles in full activity. The fibrotic areas are composed of adult fibrous tissue with few cells and much hyalinization.

In 1912, Hashimoto described four cases which, though seemingly related to Riedel's disease, had so many different features that it was considered a new disease of the thyroid. At this point, it would be well to emphasize that Riedel, in his presentation, particularly mentioned the absence of functional disorders of the gland, either before or after the operation. Further, he made no mention of any lymphoid infiltration. Then Ewing, in 1922, following his studies of four cases, concluded that both Hashimoto and Riedel were describing different processes of the same disease, Hashimoto the early, and Riedel the final stages, respectively. Joll has recently reopened the controversy and is apparently justified.

Graham, Joll and McCollough believe that no relation exists between Riedel's and Hashimoto's disease for the following reasons: (1) Hashimoto's disease is confined to women over forty-five years of age. Riedel's disease may occur at any age. Men are afflicted as often as women. (2) Regardless of an operation, Hashimoto's disease tends to develop myxedema, frequently preoperatively. Riedel's disease, even after surgery, rarely leads to defective function. (3) Hashimoto's disease is diffuse from the onset; no part of the gland escapes. In Riedel's disease, localizations to part of a gland are not uncommon. (4) Widespread formation of delicate connective tissue is found resembling that in lymphadenoid goiter. In Riedel's disease, dense fibrosis resembling scar or keloid formation is found even in early stages.

Subsequent observations have apparently not substantiated all the above made statements. Shaw and Smith report one case of Riedel's thyroiditis associated with similar changes in the adrenal glands. Again, Perman and Wahlgren, in 1927, reported an operation for Riedel's disease in a chronic partly suppurating and necrosing thyroiditis. In 1929, Heyd reported a case, the specimen from which at the first operation, was reported as Hashimoto's disease. At re-operation thirteen months later for recurrence, the specimen suggested Riedel's disease because of a diminution of the number of lymphocytes and an increase in fibrosis.

CLINICAL PICTURE

Subjectively considered, the outstanding feature is dyspnea, occurring in 50 per cent of cases, a dyspnea out of all proportion to the increase in the size of the gland. Other pressure symptoms noted are dysphagia, dysphonia, a dry cough and in more advanced cases, stridor. In the early stages, the patient may be aware of thyroid enlargement for a relatively short time. Palpitation, nervousness, irritability, tremor, hyperhydrosis and loss of weight are relatively common. Pain, either localized to the neck or radiating to the ears, shoulder or chest, is often present. The average duration of these symptoms is about ten months.

The general health seems fairly good. With evidence of myxedema almost lacking, the thyroid, in early stages, may show a localized unilateral or a diffuse symmetrical enlargement which is always smooth. In 40 per cent of the cases, the enlargement is unilateral. In more advanced cases, the thyroid and surrounding structures are fused into a diffuse mass with complete

fixation of the thyroid. This mass may occupy the entire neck anteriorly. The cervical glands are not involved. Very significant also is the lack of involvement of the skin. The trachea is usually deviated and on laryngeal examination, paralysis of one vocal cord is not unusual. Although, Bohn, Waigate, Schultz and others report cases showing mild toxic symptoms with elevation of basal metabolism. This and other laboratory tests are not significant except for radiographic evidence of displacement and compression of the trachea.

DIFFERENTIAL DIAGNOSIS

1. *Malignancy.* (a) The great majority of the malignancies of the thyroid are grafted on previous adenomas and are in patients over forty-five years of age. (b) Rapid growth of the goiter without serious impairment of health favors Riedel's thyroiditis. (c) Skin and glands are involved in malignancy but not in Riedel's disease. (d) Pain is more frequent and severe in malignancy. (e) There are invariable voice changes in malignancy of the thyroid. Dysphagia, relatively minor in Riedel's thyroiditis, is an important symptom in malignancy. (f) The surface of the thyroid is nodular in malignancy, but smooth in Riedel's disease. Malignancy of the thyroid may be associated with disturbances of the circulation.

2. *Hashimoto's Disease.* There are: (a) Preponderance in women between forty-five to sixty years of age; (b) tendency to myxedema; (c) uniform enlargement of the gland lacking the stony hardness of Riedel's disease. (d) Pressure effects are seldom as severe as with Riedel's disease. (e) Riedel's disease shows a questionable response to radium. Hashimoto's disease responds quite promptly.

3. *Infectious Thyroiditis.* There is a history of a previous gastrointestinal infection. Hyperthyroidism is a prominent feature in thyroiditis. The consistency of the thyroid is not as hard as in Riedel's disease. There may be redness, tenderness and adherence of the overlying skin. The presence of pus, fever and leucocytosis favors infectious thyroiditis.

4. *Tuberculosis.* The thyroid may be enlarged and firm. It may rapidly infiltrate the surrounding tissues. The mass is hard and painful, occasionally breaking down to form a sinus. Adjoining lymph-nodes are involved. There usually is some evidence of tuberculosis in the tonsils, sublingual and parotid glands. Evening fever may be present. Some hyperthyroidism is also present. Other stigmata of tuberculosis are present.

5. *Lues.* Gumma is usually associated with enlargement of the gland. It occurs more often among women between the ages of twenty-five to forty-five. In about 50 per cent there is a previous history of goiter. Unlike in Riedel's disease, the skin is reddened and tender. The surface of the gland may be smooth or nodular and soft. The regional glands are enlarged. There is a tendency to suppurate. The Wassermann test will prove helpful.

6. *Phlegmon.* This usually occurs in men of middle age. There usually is a preceding infection (mouth, pharynx, salivary gland). The mass is very hard, covered by a red adherent skin. Death may result from laryngeal edema, pressure or exhaustion.

7. *Actinomycosis.* There is an early board-like hardness of the neck which later softens. A sinus then forms discharging yellow granules which are typical of the disease.

DIAGNOSIS

Before any treatment is begun, every attempt to make a correct diagnosis should be made. Malignancy of the thyroid and Hashimoto's disease will probably be the most difficult. The therapeutic effect of radium should prove most helpful because of the prompt response of Hashimoto's disease. The special characteristics of Riedel's disease should offer no special difficulty in distinguishing it from malignancy, provided that whenever malignancy

of the thyroid is suspected, Riedel's disease will also be considered.

TREATMENT

If an absolute diagnosis cannot be clinically established, it will then be advisable to perform a biopsy. Such a biopsy can be done without risk and is entirely justifiable. The first object of treatment in Riedel's disease is the relief of pressure. Success has been reported with radium by Renton, Charteris and Heggie and with *x*-ray therapy by Silatchek, Maloney and others. However, keeping the gross and microscopic picture of true Riedel's disease in mind, it seems improbable that these agents can exert any but the slightest effect. The treatment, therefore, remains essentially surgical. Radical surgery is not only unnecessary but dangerous. Attempts at extirpation of the diseased thyroid have been followed by a high mortality and the most serious of complications. When only a small wedge of tissue is removed, as for a biopsy, it has been repeatedly observed that the pathology will retrogress and in many instances, all induration of the neck will have disappeared within a few months. The first essential is to make a wedge resection just over the trachea so as to relieve the pressure. In most cases, this has been sufficient to give the patient relief and cure. Where radical attempts at removal were made, injury to the trachea, esophagus and great vessels have been reported, as well as injury to the recurrent nerves resulting in bilateral abductor paralysis. Tracheotomy has been necessary in the more advanced cases.

SUMMARY

Riedel's disease is comparatively rare, and in large series of thyroidectomies, its incidence remains fairly constant. Riedel's disease must be distinguished from Hashimoto's disease. The criteria for this differentiation have been given. Inasmuch as the prognosis and treatment are different in Riedel's disease, malignancy and Hashimoto's disease, a biopsy is advocated in doubtful cases. Not only is radical resection dangerous in Riedel's disease but it is distinctly contraindicated. Wedge resection over the trachea to relieve pressure is advocated. The future value of radium and *x*-ray therapy remains to be considered. A report is made of two cases of Riedel's disease.

CONCLUSIONS

1. Riedel's disease is comparatively rare.
2. Riedel's disease and Hashimoto's disease are distinct clinical entities.
3. The treatment is based upon an exact differential diagnosis, aided if necessary, by biopsy.

REFERENCES

Austin, R. C. Chronic thyroiditis (Riedel's disease). *Arch. Surg.*, October, 1936.

Angerer, H. Riedel's Struma. *Zentralbl. f. Chir.*, August, 1933.

Balfour, D. C., Cancer of thyroid gland. *Med. Rec.*, 94: 846–850, 1918.

Benson, B. B. Riedel's struma. *Am. J. Surg.*, 27: 361–367, 1935.

Berry, J. On a further series of 500 goiter operations with special reference to after results. *Brit. J. Surg.*, 8: 413–451, 1920.

Boyden, A. M., Coller, F. A. and Bugher, C. Riedel's struma. *West. J. Surg.*, 43: 547–563, 1935.

Bowlby, A. A. Infiltrating fibroma (? sarcoma) of thyroid gland. *Tr. Path. Soc.*, 36: 420–423, 1884–1885.

Bohan, I. T. Ligneous thyroiditis associated with high grade dental infection. *M. Clin. North America*, 7: 1069–1074, 1924.

Bruce, H. A. Thyroiditis simplex (Riedel's tumor) case. *Ann. Surg.*, 94: 562, 1931.

Brunger, H. Ueber Operationstod bei thyroiditis Chronica. Gleich Zeitigen Beitrag zu den Beziehungen Zwischen Basedowischer Erkrankung und Thyreoditis. *Mitt. a d. Grenzgeb. d. Med. u. Chir.*, 28: 213–242, 1915.

Cameron, J. A. M. Riedel's thyroiditis. *Tr. Roy. Med.-Chir. Soc. Glasgow*, pp. 99–101, 1937–1938.

Clute, H. M., Eckerson, E. B. and Warren, S. Clinical aspects of struma lymphomatosa (Hashimoto). *Arch. Surg.*, 31: 419–428, 1935.

Charteris, A. A. and Heggie, J. F. Riedel's thyroiditis and its treatment by radium. *Brit. J. Surg.*, 26: 54–70, 1938.

Crane, W. Chronic thyroiditis. *California & West. Med.*, 35: 443–498, 1932.

Eisen, D. Riedel's struma. *Canad. M. A. J.*, 31: 144–147, 1934.

Eisen, D. Riedel's struma. *Am. J. M. Sc.*, November, 1936.

Ewing, J. Neoplastic Diseases. Philadelphia, 1928. W. B. Saunders.

FERNANDEZ, F. LOPEZ and FUSTE, R. *Bol. Liga contra el cáncer*, 12: 373–396, 1937.

GERLACH, K. Chronic fibrous struma with retraction manifestations: resemblance to Riedel's struma. *Beitr. z. klin. Chir.*, 154: 563–574, 1932.

GRAHAM, A. and MCCULLAGH, E. R. Atrophy and fibrosis assoc. with lymphoid tissue in the thyroid. Struma lymphomatosa (Hashimoto). *Arch. Surg.*, 22: 548–567, 1931.

GRAHAM, A. Riedel's struma in contrast to struma lymphomatosa (Hashimoto). *West. J. Surg.*, p. 681, September, 1931.

HASHIMOTO, H. Zur kenntniss der lymphomatosen Veranderung der Schildrusse. *Arch. f. klin. Chir.*, 97: 219–248, 1912.

HEYD, C. G. Riedel's struma, benign granuloma. *Surg. Clin. North America*, June, 1929.

HOWARD, L. L. Struma lymphomatosa Hashimoto. *Am. J. Surg.*, 23: 565, 1934.

HORI, M. Riedel's struma (2 cases). *Ztschr. d. japan. chirurg. Gesellsch.*, 36, 1934.

JAFFE, R. H. Thyroiditis chronic. *J. A. M. A.*, p. 105, January 9, 1937.

JARVIS, DEF. C. Riedel's disease case. *Tr. Am. Laryng. A.*, 60: 71–72, 1938.

JOLL, C. A. Diseases of Thyroid Gland. Pp. 11–117. St. Louis, 1932. C. V. Mosby.

KRENZBAUER, F. H. Riedel's fibrous (ligneous) thyroiditis. *Arch. f. klin. Chir.*, 163: 86–107, 1930.

LAKE, W. F. and AYERS, A. J. Struma lymphomatosa and Riedel's struma. *South. M. J.*, 29: 665–669, 1936.

LEE, C. M. and MCGRATH, E. J. Struma lymphomatosa (Hashimoto) survey of literature and case report. *Surgery*, 2: 238–246, 1937.

MALLET-GUY, BARLIER, J. and HEITZ. Thyroidite ligneuse chronique. *Lyon méd.*, 141: 350–353, 1928.

MALONEY, J. J. Ligneous thyroiditis (Riedel's disease). *J. Med.*, 10: 586–589, 1929.

MALLET-GUY, J. Ligneous chronic thyroiditis. *Lyon méd.*, March, 1928.

MCCLINTOCK, J. C. and WRIGHT, A. W. Riedel's Struma and struma lymphomatosa (Hashimoto comparative study). *Am. J. Surg.*, 106: 1132, 1937.

MELINA, F. Riedel's struma. Ligneous thyroiditis. *Gazz. internaz. med.-chir.*, 41: 443–451, 1933.

MEEKER, L. H. Ligneous thyroiditis. (Riedel's struma associated with remnants of post-bronchial body). *Am. J. Path.*, 1923.

MONOD, G. R. Contribution et 'etude de la Maladie de *Riedel. Theses de doctorate Paris J. de chir.*, 27: 1–2, 1923.

PAYR, E. Iron hard strumitis of Riedel. *Rep. Internat. Conf. Goitre*, 1927.

PERMAN, E. and WAHLGREN, F. Case of chronic thyroiditis (Riedel). *Acta. chir. Scandinav.*, 61: 535–542, 1927.

POLOWE, D. Struma lymphomatosa (Hashimoto) associated with hyperthyroidism. Case with clinical and histopathologic study. *Arch. Surg.*, November, 1934.

RENTON, J. M., CHARTERIS, A. A. and HEGGIE, J. F. *Brit. J. Surg.*, 26: 54–70, 1938.

RIEDEL, D. Ueber Verlauf und Ausgang der Strumitis. *München med. Wchnschr.*, 1910. Die chronische zur Bildung Eisenharter Tumoren fuhrende Entzundung der Schildrusse. *Verhandl. d. deutsch. Gesellsch. f. Chir.*, 1896.

SMITH, L. and CLUTE, Chronic ligneous thyroiditis (Riedel's Struma). *Am. J. M. Sc.*, 172: 403–416, 1926.

SPANAUS, K. Die Riedel'sche Struma. *Beitr. z. klin. Chir.*, 70: 611–626, 1910.

STARLINGER, F. and RICHTER, W. Thyroiditis and strumitis; pathology, clinical aspects and influence on late sequels on function of thyroid. *Wien. klin. Wchnschr.*, 46: 678–683, 1933.

ST. GEORGE, A. V. Chronic productive thyroiditis. *Am. Surg.*, 80: 25–30, 1924.

TAILHEFER, E. Inflammation chronique primitive (cancereforme) de la glande thyroide. *Rev. de chir.*, 18: 224–231, 1898.

TRAUM, E. Recurrence of Riedel's ligneous thyroiditis after partial resection of thyroid. *Deutsche Ztschr. f. Chir.*, 231: 635–637, 1931.

VIRCHOWS, F. Characteristic vascular conditions in chronic thyroiditis (Riedel's struma). *Arch. f. path. Anat.*, 280: 640–648, 1931.

WILLIAMSON, C. and PEARSE, I. H. Lymphadenoid goiter and its clinical significance. *Brit. M. J.*, 1: 4–5, 1929.

WINGATE, H. F. Riedel's chronic thyroiditis. *Brit. J. Surg.*, October, 1929.

EXSTROPHY OF RECTAL MUCOSA

JEROME M. LYNCH, M.D. AND G. JOHNSON HAMILTON, M.D.
Attending Proctologist, New York Polyclinic Medical School and Hospital
Assistant Proctologist, New York Polyclinic Medical School and Hospital
NEW YORK, NEW YORK

EXSTROPHY of the rectal mucosa is becoming a rarity. The condition merits discussion since its symptomatology is crippling and its surgical cure is often simple.

This syndrome usually is a late complication of the radical excision of hemorrhoids, especially if the choice of operation has been ill advised or its performance faulty. The operation described by Whitehead in 1882 was peculiarly susceptible to both of these errors in the hands of the relatively inexperienced. There can be no doubt that certain cases do merit some similar procedure but such cases are few and far between and demand special skill on the part of the operator. Unfortunately, neither of these facts was appreciated by the rank and file, although obvious to the expert. Hence, many patients were subjected to unnecessarily severe operative procedures which often resulted in crippling complications.

Whitehead[1] described the operation as follows:

"1. The patient, previously prepared for the operation and under the complete influence of an anesthetic, is placed on a high, narrow table in the lithotomy position, and maintained in this position either by a couple of assistants or by Clover's crutch.

"2. The sphincters are thoroughly paralyzed by digital stretching, so that they have 'no grip,' and permit the hemorrhoids and any prolapse there may be to descend without the slightest impediment.

"3. By the use of scissors and dissecting forceps, the mucous membrane is divided at its juncture with the skin round the entire circumference of the bowel, every irregularity of the skin being carefully followed.

"4. The external and the commencement of the internal sphincters are then exposed by a rapid dissection and the mucous membrane and attached hemorrhoids, thus separated from the submucous bed on which they rested, are pulled bodily down, any undivided points of resistance being snipped across, and the hemorrhoids brought below the margin of the skin.

"5. The mucous membrane above the hemorrhoids is now divided transversely in successive stages, and the free margin of the severed membrane above is attached, as soon as divided, to the free margin of the skin below by a suitable number of sutures. The complete ring of pile-bearing mucous membrane is thus removed.

"Bleeding vessels throughout the operation are twisted on division."

This differs from his original technic in that islands, or rather peninsulas of mucous membrane, are no longer preserved and these anchors to windward are sorely missed.

The complications of this technic, even when properly performed, are failure of primary union, leading to stricture formation and destruction of the sensitive organs of the lower end of the rectum. This stricture is a particularly difficult one to deal with since it necessitates not only excision of the scar tissue but exact coaptation of the mucous membrane and skin at the precise point where nature intended the mucocutaneous junction to find itself. Failure to attain this difficult goal will give rise to one of two sad syndromes. These are similar to the complications resulting from poor technic in the performance of the Whitehead

operation and hence will be described with them.

Mr. Whitehead, in describing his technic,

Fig. 1. Exstrophy of rectal mucosa following an imperfect operation for hemorrhoids.

expressed himself poorly so that one who failed to study the paper might be misled upon two most important points, namely, the exact site of the first incision and the structures to be united with sutures. The exact site of the first incision should be into the mucous membrane just above the mucocutaneous junction since only in this manner can the cut borders of the caudad and cephalad mucous membrane be united. If the first incision be made through skin, then, barring a miracle, one of two complications will surely follow: Either the mucosa will be drawn down outside of the canal and exstrophy result or, more rarely, the skin will be drawn up into the canal.

Exstrophy of the mucous membrane may produce any or all of the following symptoms: a constant sensation of moisture about the parts, a burning sensation, a foul feculent odor, pains of darting, dragging, or neuritic nature. The latter are usually labelled neurotic, or worst of all, incontinence.

If the skin be drawn up into the canal, it will soon become moist, sodden and excoriated. Later a feculent discharge will be produced which will irritate, burn and sting until life is almost unbearable.

The simple operation of ligation and excision of hemorrhoids may result in similar pathology if too much skin is excised. This mistake is easily made if there are many skin tabs and the surgeon tries for too perfect a cosmetic effect. The exstrophic mucous membrane will then resemble a clover leaf. If only one of these is present, it is often mistaken for a fissure.

These accidents are preventable in the main. No one should attempt such a radical procedure unless it is certain that no other therapy will effect a cure and then only if the skill of the operator is unquestioned. For many years it has been the custom in many hospitals for most rectal operations to be turned over to the internes. This not only leads to bad surgery during their period of training, but launches them into private practice improperly trained and with little understanding of the anatomic and physiologic principles which should govern rectal surgery. It is appalling how many surgeons and even self-designated proctologists, are unfamiliar with the work of such men as Milligan, Morgan[2] and Levy[3] who have clarified the anatomy of the pelvic outlet. No one would dream of operating upon any other part of the body without first learning its anatomy, yet the rectum is assaulted daily by operators who have had no real surgical training.

The surgical cure of exstrophy of the rectal mucosa demands a plastic operation and elasticity negatives a rigid technic. The surgeon's own good judgment, as he proceeds with the operation, must be his guide. It is, however, very helpful to consider all possible methods before commencing to operate so that little time may be lost in pondering the most suitable method of meeting the immediate problem. We have found the following technic a simple one to alter when exigencies, encountered at operation, demand.

PROCEDURE

After adequate preoperative preparation, the patient is placed upon the operating table in the lithotomy position or the left Sims' position and the area is cleansed with 10 per cent tannic acid in alcohol. Anesthesia is attained through infiltration with ½ per cent novocaine.

An incision is made through the mucous membrane just cephalad to its junction with the scar tissue and extending the whole circumference of the exstrophy. The free border of the bowel is grasped with forceps. The scar tissue is excised exposing a portion of the external sphincters. The redundant gut is excised and its free border is attached to its proper site with interrupted sutures. Radial incisions are made in the skin and their edges are trimmed in such a manner that the skin meets the mucous membrane and is maintained in position, without strain, by interrupted sutures. The following cases illustrate variations in this technic.

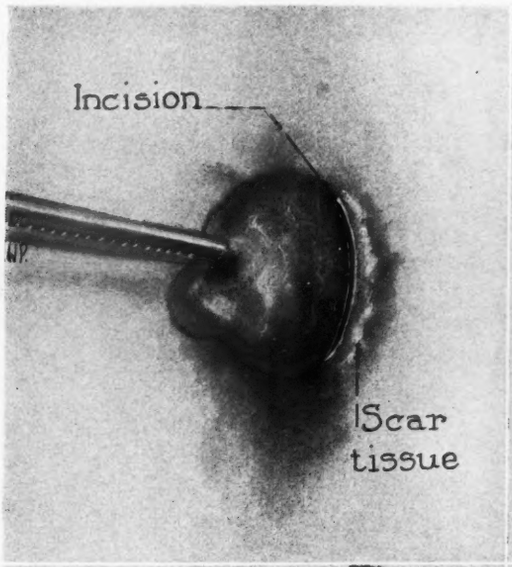


Fig. 2.

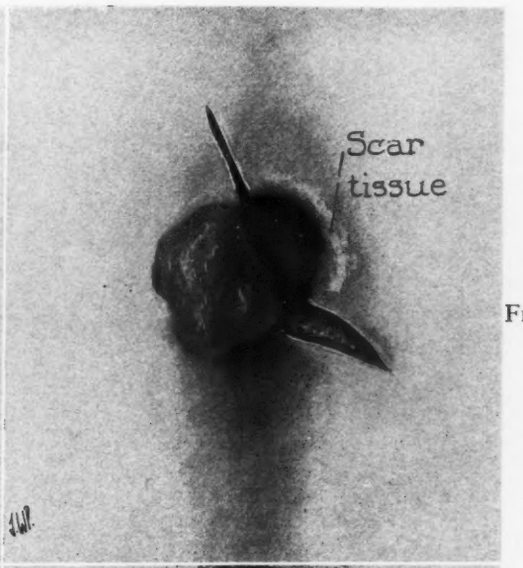


Fig. 3.

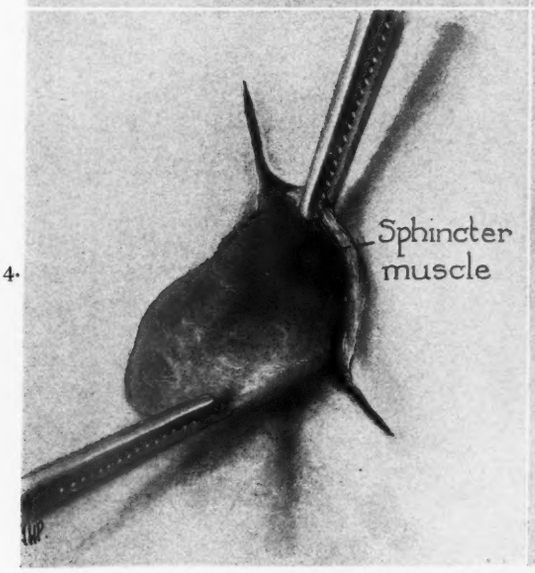


Fig. 4.

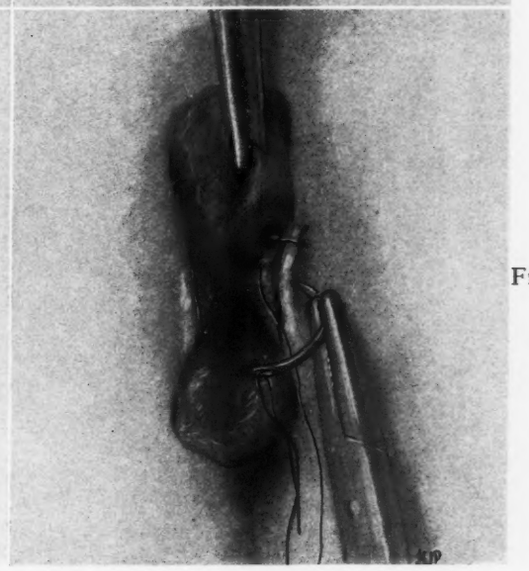


Fig. 5.

Fig. 2. Incision through mucosa.
Fig. 3. Radial incisions.
Fig. 4. External sphincters partially exposed.
Fig. 5. Suturing mucosa.

CASE REPORTS

CASE I. A boy, aged twelve, was born with an imperforate anus. A series of operations performed elsewhere had left him with an exstrophic perineal stoma and complete incontinence of feces.

Local anesthesia (novocaine ½ per cent) was administered. With the patient in the left Sims' position, the perianal area was infiltrated with ½ per cent novocaine solution. The exstrophic mucous membrane extending from 5 to 12 o'clock was dissected free above the mucocutaneous junction. The redundant bowel in the posterior line was delivered and a pedicle transfixed and ligated. The excess bowel was then excised. At 9 and 11 o'clock the structures were treated in the same manner. All bleeding points were clamped and tied. The wound was packed with gauze.

The boy gained almost complete control of his bowels and was allowed to go to camp and associate with other boys on an equal footing for the first time in his life. It is probable that a similar operation on the other side will give complete control.

CASE II. A woman, aged fifty-five, complained of a constant burning pain about the anus and occasional shooting pains into the

FIG. 6.

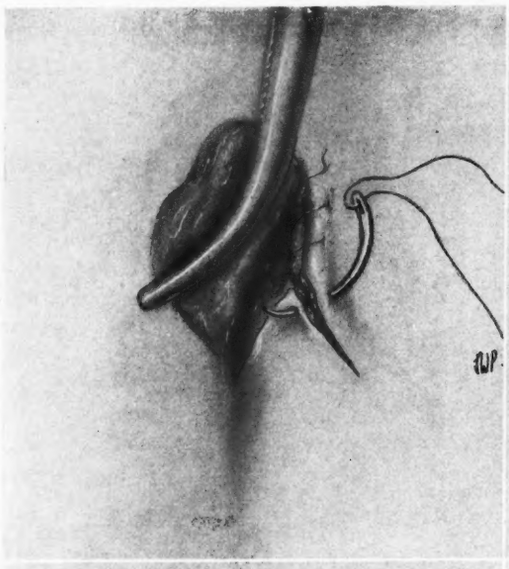


FIG. 7.

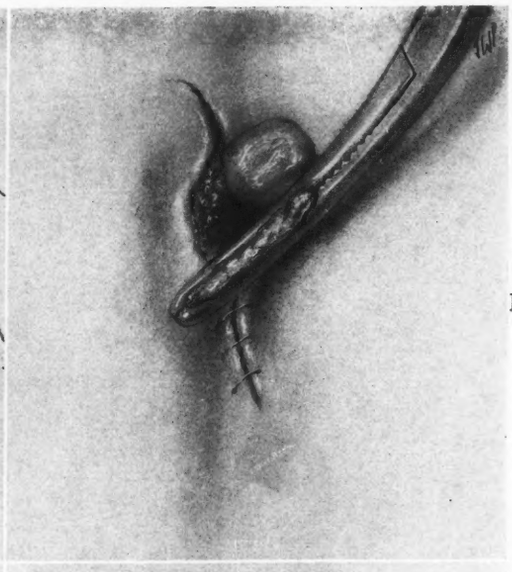


FIG. 8.

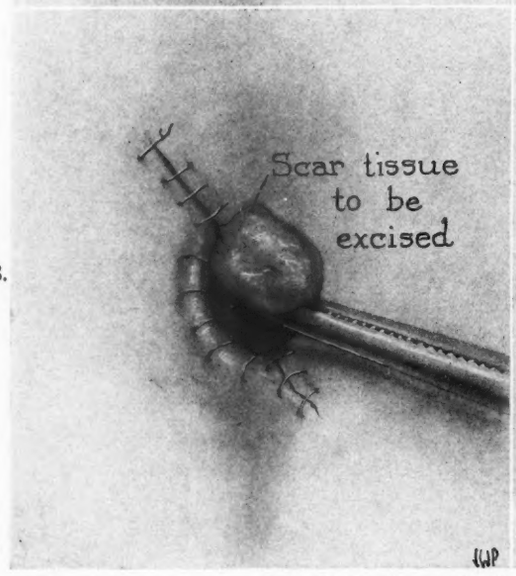


FIG. 9.

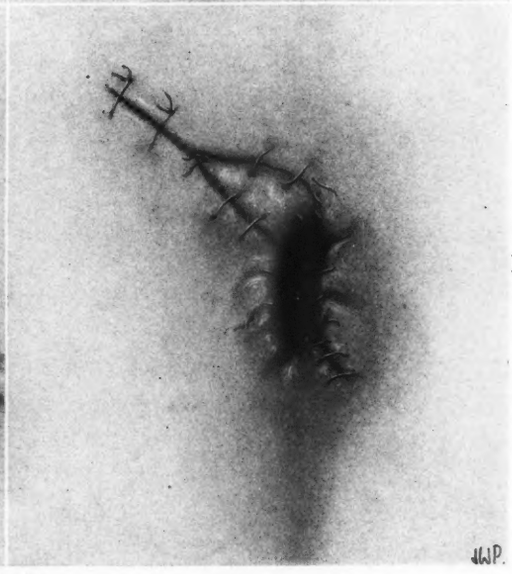


FIG. 6. Closing radial incision.
FIG. 7. Method of excising redundant mucosa.
FIG. 8. Scar tissue to be excised.
FIG. 9. Operation complete.

rectum. She had undergone four operations for hemorrhoids before consulting us. Exstrophy of the mucosa was present throughout the entire circumference of the bowel except from 8 to 9 and 3 to 4 o'clock at which two points there were peninsulas of skin extending up to the original mucocutaneous junction.

The operation consisted of the excision of the redundant mucosa at the level of the intermuscular septum and the control of bleeding. It was not considered necessary to suture the bowel in place since its position was maintained by the anchors left at the extremities of the transverse diameter. The wound was packed with gauze soaked in 10 per cent tannic acid in alcohol to encourage healing by granulation without scarring.

The patient states that she is much improved.

Case III. A man, aged fifty-five, had undergone simple hemorrhoidectomy elsewhere. Apparently there had been many skin tabs and the surgeon had removed too much skin leaving a clover leaf exstrophy. The patient was complaining of a severe burning pain and pruritus ani.

Under ½ per cent novocaine anesthesia, the "clover leaves" were excised. The skin edges were freed and sutured together without tension. The wound was packed with gauze soaked in 10 per cent tannic acid in alcohol. The symptoms disappeared completely.

SUMMARY

1. Exstrophy of the rectal mucosa may produce crippling symptomatology.

2. It may be a late complication of the radical excision of hemorrhoids or even follow simple hemorrhoidectomy injudiciously performed.

3. Usually it may be avoided by a more careful selection of cases and a more thorough training for surgeons.

4. A plastic operation for its cure is described together with three variations in technic.

REFERENCES

1. Whitehead, Walter. *Brit. M. J.*, 1: 149, 1882.
2. Milligan and Morgan. *Lancet*, p. 1119, Nov. 13, 1937.
3. Levy. *Am. J. Surg.*, 45: 357, 1939.

PREGNANCY AND DELIVERY WITH AN INTRAUTERINE PESSARY IN THE CERVIX*

THURSTON S. WELTON, M.D. AND OREN ELLINGSON, M.D.
BROOKLYN, NEW YORK

ALTHOUGH modern medical teaching credits intrauterine contraceptive appliances with only historical significance, their use is, unfortunately, still quite common, especially among those persons desiring a contraceptive device which relieves them of the "bother" associated with most present day methods.

The most commonly used of these is the gold plated "button" or "wish-bone" type of intrauterine stem. They are usually introduced after capping the pronged ends with a digestible capsule which permits easy introduction into the cervical canal and causes the spring to be subsequently released, thereby retaining the stem in the uterine cavity. It is usually left in place for months or years and is removed only for periodical cleansing. They do not commonly interfere with menstruation. Their apparent effectiveness is probably dependent upon the production of chronic endometritis, preventing nidation or bringing about an early abortion.

The literature is replete with articles pointing out the dangers attending the use of these devices.[1] They act as ladders for ascending infection into the uterine cavity, thus frequently causing salpingitis, endometritis and peritonitis. They call for the presence of a foreign body in the cervical canal and uterine cavity over long periods of time with consequent irritation, infection and possible carcinogenic action. They risk perforation of the uterus at the time of introduction. The intrauterine spring type frequently results in the imbedding of the prong within the uterine wall, and in a few cases, these have caused perforation of the uterus.[2] Extrauterine pregnancy, probably favored by the endometritis and salpingitis accompanying the irritating foreign body, has been reported.[3,4,5]

Although intrauterine gestations do occur, they usually result in early abortions.[6] The German literature contains two cases of pregnancy in the presence of an intrauterine stem pessary, one, a full term living child.[7,8]

A case of delivery of a seven-month living infant, in spite of the use of an intrauterine stem pessary, is reported here:

CASE REPORT

E. K., age thirty-seven, a white gravida VIII, para VII, was enrolled in the Out-patient Obstetrical Clinic of Greenpoint Hospital on January 23, 1941, and informed the examiner that her membranes had just ruptured. This fact was established by rectal examination and the patient was immediately admitted to the hospital.

In January, 1937, the patient had had a gold plated intra-uterine "wish-bone" type stem pessary introduced by a physician for contraceptive purposes. She was told that, although pregnancies might occur, they would quickly terminate in early, spontaneous miscarriages. When the pessary was removed a year later for cleansing, the patient promptly became pregnant and delivered a full-term infant in the breech position on October 28, 1939. This child died eight months later from measles complicated by meningitis. The pessary was then re-introduced in January, 1940. When the patient reported to her physician in July for removal and cleansing of the appliance, she was found to be about three weeks pregnant. Her last menstrual period was July 3, 1940. Attempts at removal of the pessary were unsuccessful and resulted in considerable bleeding which continued for two weeks. Because the patient did not want to lose the pregnancy she did not seek further medical care until coming to Greenpoint clinic at the time her membranes

* From the Department of Obstetrics and Gynecology, Greenpoint Hospital, Brooklyn, New York.

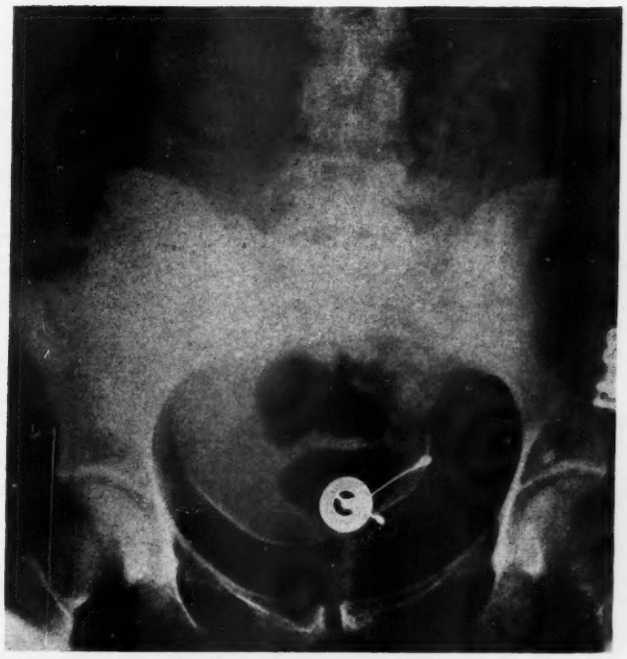


Fig. 1. *X*-ray showing stem-pessary in the pelvis close to fetal skull.

Fig. 2. Photograph of infant shown holding the pessary which was imbedded in its scalp.

had ruptured. The antepartum course was otherwise uneventful. Fetal movements were noted three months prior to admission. There had been no edema, nausea, emesis, headaches, vertigo, dyspnea, constipation or vaginal bleeding.

The patient was married nineteen years. Her husband was living and well. She had had seven full-term pregnancies all spontaneous; two were breech deliveries. The largest baby was 12 pounds at birth. One child born in 1922 lived one month. The cause of death was undetermined. One spontaneous abortion of one month's gestation occurred in 1932.

On admission a purulent foul smelling watery discharge was seen coming from the vagina. Rectal examination revealed the cervix to be thick and from the os, which was dilated about 2 cm., a hard object protruded. This was a stem-pessary. The vertex was 3 cm. above the spines of the ischia and the fetal membranes were ruptured.

A flat plate *x*-ray of the abdomen revealed a seven-month fetus in vertex presentation with a stem-pessary visible in the pelvis in close apposition with the fetal skull. (Fig. 1.)

Labor pains began at 12 A.M. on January 25, just forty-eight hours after rupture of fetal membranes. At 6 P.M. the patient was spontaneously delivered of a well formed seven-month fetus, 36.3 cm. long, weighing 2 pounds 6 ounces. The *stem-pessary was imbedded in the fetal scalp* but was easily removed, leaving a noticeable but transient impression of the instrument. The infant was placed in a Davidson incubator and respirations of a weak, shallow character were soon established, although no cry was evidenced. The infant was apparently normal except for the depression in the scalp and a bluish discoloration of the right foot and fifth left digit. (Fig. 2)

The placenta was delivered intact spontaneously ten minutes after delivery of the child. Blood loss was 100 cc. Ergotrate, $\frac{1}{320}$ gr. was given intramuscularly to the mother and she was returned to the ward with a temperature of 101.2°F. and pulse of 120. The temperature had been constantly elevated during labor and it was believed that intragenital infection was the etiologic factor.

A daily prophylactic dose of sulfathiazole, gr. 12, four times a day, was given although no uterine culture had been taken, and the temperature gradually subsided to normal on the sixth day postpartum. Ethenyl estradiol, 5 gr., was given three times a day for three days to inhibit lactation. On the tenth day postpartum the patient was discharged to the out-patient department with a well involuted uterus, clear parametria and adnexae and good pelvic support.*

The mother was examined six weeks after delivery and was found to be in good general condition. The pelvis was found to be essentially that of a normal multipara.

REFERENCES

1. Nordmeyer, K. *Deutsche med. Wchnschr.*, 22: 1950, 1936.
2. Sussex, L. T. *J. A. M. A.*, 100: 1490–1491, 1933.
3. Schneider, L. *Ztschr. f. Geburtsch. u. Gynäk.*, 59: 2168–2178, 1935.
4. Meyer, R-Wildisen: *Schweiz. med. Wchnschr.*, 64: 1009–1010, 1934.
5. Ottow, B. *Ztschr. f. Geburtsch. u. Gynäk.*, 110: 344, 1935.
6. McVay, L. C. *Nebraska M. J.*, 24: 171, 1938.
7. Thomsen, K. *Zentralbl. f. Gynäk.*, 61: 1171, 1937.
8. Sjovall, A. *Zentralbl. f. Gynäk.*, 57: 2598, 1933.

* The infant was discharged from the hospital sixty-seven days postpartum in good condition weighing six pounds three ounces.

PRIMARY OVARIAN PREGNANCY*

CASE REPORT

EDWIN BRECK ECKERSON, M.D.
NEW YORK, NEW YORK

IN 339 cases of ectopic pregnancy at St. Luke's Hospital in the past forty years, the following one is the only case of primary ovarian pregnancy, an incidence of 0.2 per cent.

CASE REPORT

The patient, A. B., was a thirty-eight-year old German woman who was separated from her husband and whose only previous pregnancy terminated in a miscarriage twenty years before. She gave a history of an attack of abdominal pain six years ago, diagnosed as "inflamed ovaries." Her menstrual periods had always been regular and normal and her last period was just two weeks previous to the onset of her symptoms with no bleeding since then. She was admitted to St. Luke's Hospital on September 30, 1939, six hours after the onset of sudden severe crampy generalized abdominal pain, which awakened her at 6 A.M. From the onset of the pain, which persisted without change, she was unable to lie down without marked increase in the pain and faintness.

On examination she was pale, apprehensive and obviously acutely ill. She sat up in bed somewhat bent over forward holding her abdomen and was absolutely unable to lie down. Her abdomen, examined in this posture was slightly protuberant and doughy and showed only moderate tenderness, mostly in the left lower quadrant, and marked rebound tenderness but practically no spasm. By pelvic examination there was marked tenderness in both fornices with a sense of fullness on the left. It was believed that her inability to lie down was due to a shift of intra-abdominal blood into the subdiaphragmatic region on attempting this change of position.

She had a normal temperature, a pulse of 100, and a blood pressure of 82/48. Her blood count was 63 per cent hemoglobin, 3,600,000 red cells, and 23,900 white cells, with 92 per cent polymorphonuclears, and her Wassermann test was negative.

Because of the menstrual history she was thought to have a ruptured Graafian follicle with rather severe bleeding.

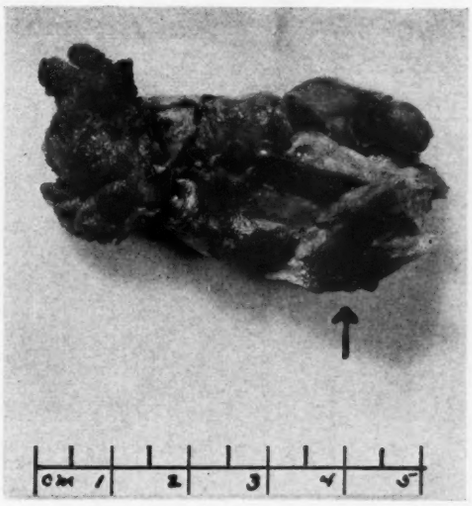


FIG. 1. Photograph of gross specimen. Sections have been cut from the tube, ovary and pregnancy. The tube lies above with the ovary beneath it. Arrow points to the pregnancy, which is about 1 cm. in diameter.

At operation a large amount of clotted and fluid blood was found filling the peritoneal cavity. The right tube and ovary and the uterus were normal. The left tube and ovary were attached to the back of the broad ligament by filmy adhesions. The tube was apparently normal and the ovary was somewhat enlarged and contained on its lateral surface an open follicle about 1 cm. in diameter which was bleeding actively. A left salpingo-oophorectomy was done and a 500 cc. indirect blood transfusion given.

The postoperative course was uneventful and she was discharged on the thirteenth day. There was no vaginal bleeding during her hospital stay.

Microscopic sections showed the ovary to be involved in a hemorrhagic process with much

* From the Surgical A Service, St. Luke's Hospital, New York, New York.

interstitial hemorrhage but with portions of the ovary remaining almost intact. There were chorionic villi near the surface, embedded in fibrinous blood clots. In a few areas there were syncytial cells and a marked decidual reaction. The tube was edematous but otherwise normal. The pathologist, Dr. Leila C. Knox, said, "Since there is undoubtedly a pregnancy, it must be considered of the ovarian type, and is situated entirely outside the tube."

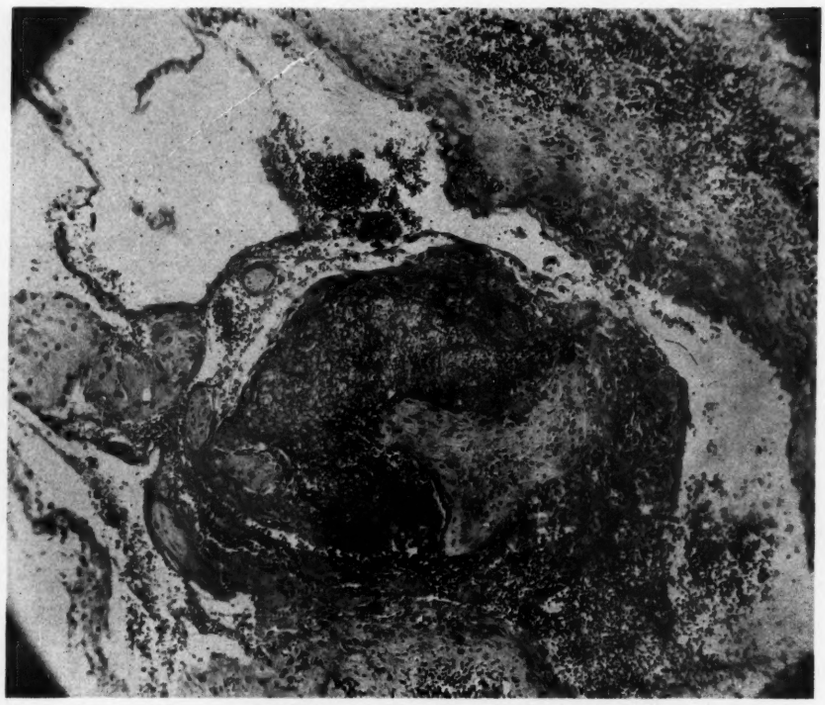


FIG. 2. Microphotograph showing chorionic villi.

Some of the reported cases do not meet all the requirements laid down by Spiegelberg in 1878 and later augmented by Williams and Norris.[1,2,3] These are: (1) The tube on the affected side must be intact and microscopically free from any evidence of gestation. (2) The fetal sac must occupy the position of the ovary. (3) The mass must be connected with the uterus by the utero-ovarian ligament. (4) Definite ovarian tissue must be found in the sac wall and be present in several portions of the wall at some distance from one another. This case easily meets all of these criteria.

There are two theories of ovarian pregnancy. One, that on rupture of the Graafian follicle, the ovum remains behind and is fertilized and develops in situ.[1,2] The other view is that the ovum escapes from the ruptured follicle, is fertilized and for some reason does not move into the tube but implants in the ovary, either in the original Graafian follicle or elsewhere. The latter theory is probably the correct one. If it develops in the follicle, the trophoblast destroys the corpus luteum which forms, and the lutein cells make up some of the decidua. In some of the reported cases a corpus luteum was present in the ovary outside the pregnancy.[4] In this case there was none. Question has been raised as to whether any true decidua forms in the ovary.[1,2,5] There seems to have been one in this case.

The duration of the pregnancy is usually longer in the ovarian than in the tubal type[1,2] because of the elasticity and resiliency of the ovary, and cases have been reported which went on to full term or to lithopedia.[1,6] This case is unusual in the short duration and early rupture of the pregnancy, evidently not over two weeks, since the patient had an evidently normal

menstrual period just two weeks before the onset of her symptoms and operation.

REFERENCES

1. Litzenberg, J. C. Nelson's Surgery. Vol. VII, p. 536. Philadelphia, Thomas Nelson and Sons.
2. Schumann, E. A. Extra-uterine Pregnancy. New York, 1921. D. Appleton & Co.
3. Norris, C. C. Primary ovarian pregnancy and report of a case combined with intra-uterine pregnancy. *Surg., Gynec. & Obst.*, 9: 123, 1909.
4. Studdiford, W. E. and Lardaro, H. H. Primary ovarian pregnancy. *Am. J. Surg.*, 33: 566–569, 1936.
5. Jordan, H. E., Garrett, B. C. and Norfleet, W. J. History of case of ovarian pregnancy at end of second month. *Surg., Gynec. & Obst.*, 54: 484, 1932.
6. Cramer, R. R. Ovarian pregnancy. *Surg., Gynec. & Obst.*, 52: 98, 931.

Prolonged pressure congestion or disease in and about the damaged joint, involving ligaments, tendons, nerves, and fasciae, draws all the moving parts into the scar and tends to bind the involved tissues and structures permanently together, usually in malposition.
From—"Wounds and Fractures"—by Orr (Charles C. Thomas).

STERILIZATION OF THE OVARIES BY ROENTGEN RAYS IN THE TREATMENT OF DISTANT METASTASES FROM PRIMARY CARCINOMA OF THE BREAST*

REPORT OF TWO CASES

ERNST A. POHLE, M.D.
Professor of Radiology, University of Wisconsin Medical School
MADISON, WISCONSIN

PRIMARY carcinoma of the breast as well as its bone and lung metastases in women sometimes recede following castration.[1–4] The mechanism of the effect is not exactly known although there seems to be little doubt that the withdrawal of the hormones is responsible to a large extent. This assumption becomes especially convincing if sterilization is brought about by roentgen rays and the secondary deposits are so far remote from the pelvic fields of irradiation that a direct effect on the metastatic lesions is hardly probable. For that reason we are reporting two illustrative cases, one with widespread bone and early lung involvement and one with bilateral lung metastases.

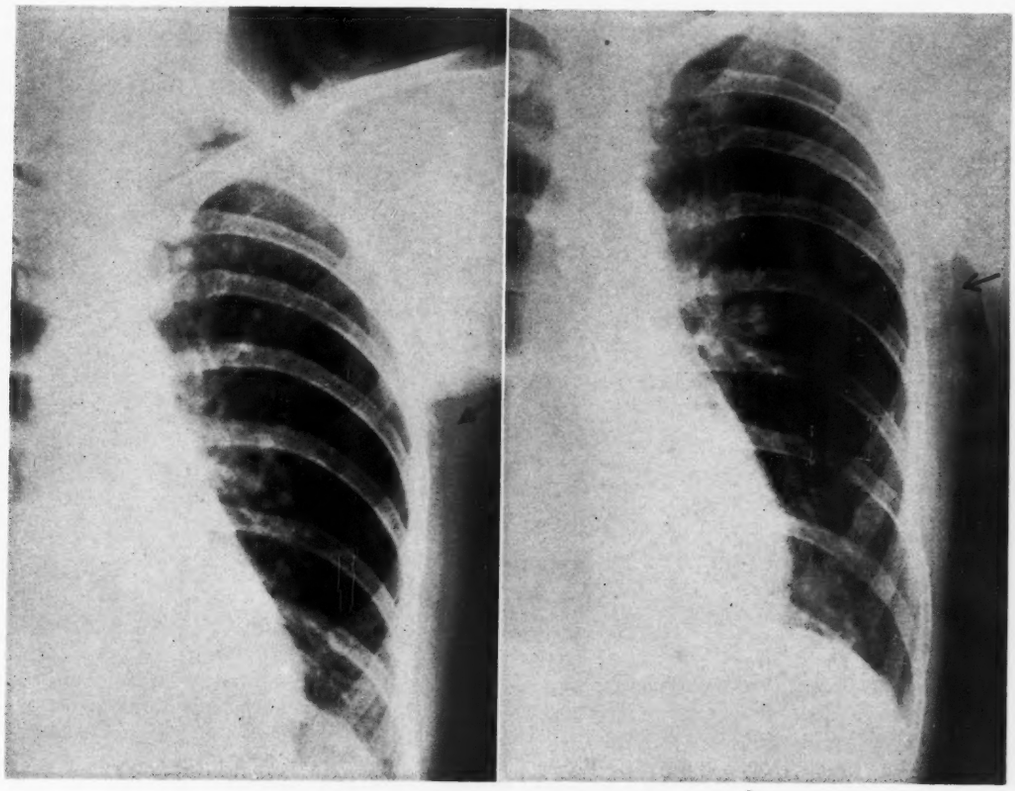
CASE REPORTS

CASE I. Mrs. M. B., thirty-nine years old, was admitted to the State of Wisconsin General Hospital on August 12, 1939, complaining of stiffness and pain in the joints and also of persistent cough. Two years ago she had the left breast removed for carcinoma; one month ago a recurrent nodule was excised from the left axilla. *X*-ray examination revealed metastatic carcinoma in the right first, third and fourth ribs, in the inferior lateral aspect of the left scapula, in the eleventh thoracic and third lumbar vertebrae, in the pelvis, the right femur and also pulmonary metastases to the bases of both lungs. On August 16, 17, 18 and 19 she received 200 r in air with customary deep therapy technic (HVL in Cu .85 mm.) over the anterior and posterior pelvis to produce sterilization. On re-examination in October, 1939, she had experienced "remarkable" relief from pain, her menstruation had stopped, but there was some advance in the destructive lesions seen before. Local *x*-ray therapy was applied to the neck of the right femur to guard against pathologic fracture. She remained free from pain until April, 1940. *X*-ray examination showed well marked recalcification of all bone lesions; the only evidence of a new metastasis was a healing fracture in the left sixth rib. The lung lesion had also receded. Special attention is drawn to the reconstruction of the tip of the left scapula which was found almost entirely destroyed on first admission. (Figs. 1*a* and *b*.) She complained of discomfort in the right lower abdomen; a hard mass about 4 cm. in diameter could be felt there. *X*-ray therapy was given over that region. Several metastatic skin nodules under the right breast were removed for psychic reasons only; microscopic examination showed adenocarcinoma. Since then new lesions have developed in the pelvis, left femur and the left sixth rib. Local *x*-ray therapy was administered to the left hip and femur to relieve pain. On last admission in January, 1941, new foci in the thoracic spine and the right humerus had appeared. The latter was irradiated because of pain. She complained of several attacks of nausea which occurred before *x*-ray therapy had been started. The lesion in the left scapula remained calcified and the lung parenchyma was clear.

CASE II. Mrs. L. K., forty-seven years old, was admitted to the State of Wisconsin General Hospital on May 26, 1937, with the chief complaint of a lump in her left breast. She stated

* From the Department of Radiology and Physical Therapy, State of Wisconsin General Hospital.

that she had noticed the lump about four years ago and at that time it was the size of a hazelnut. She had never had any pain in the left breast until one week before admission. This was accompanied by a continuous itching. There has never been any discharge from the nipple. She consulted her family physician first on May 22, 1937, who referred her to this hospital for treatment. On examination the left breast was larger than the right and a mass about the size of a large egg could be felt in the upper, inner and outer quadrants. The skin was attached to the mass but the latter was not attached to the underlying muscle. It was stony hard and nodular. Several enlarged glands were palpable in the left axilla; they were fixed, hard and not tender. *X*-ray examination of the chest revealed bilateral metastases, especially in both bases, and a bone lesion was present in the wing of the left sacrum. In view of these findings a simple mastectomy plus excision of as many axillary nodes as possible was done. Histologically, the tumor was classified as duct carcinoma. Since the patient was still menstruating, although there were indications of beginning climacteric—she had missed several periods and those that did occur were accompanied by metrorrhagia—castration by roentgen rays seemed advisable and was carried out on June 7 to 11 with the same technic as described in Case 1. The patient was seen at regular intervals; in November, 1937, the lung lesions had disappeared. The patient remained well for almost two years; (Figs. 2 *a* and 2 *b*) in May, 1939 she developed glandular metastases in the left cervical region; following surgical removal local *x*-ray therapy was given. On re-examination in October, 1939, extensive lung metastases were found, also lesions in the right hilum. When last seen in April, 1940, the presence of widespread metastases in both lungs and skeleton rendered further *x*-ray therapy futile.



a *b*

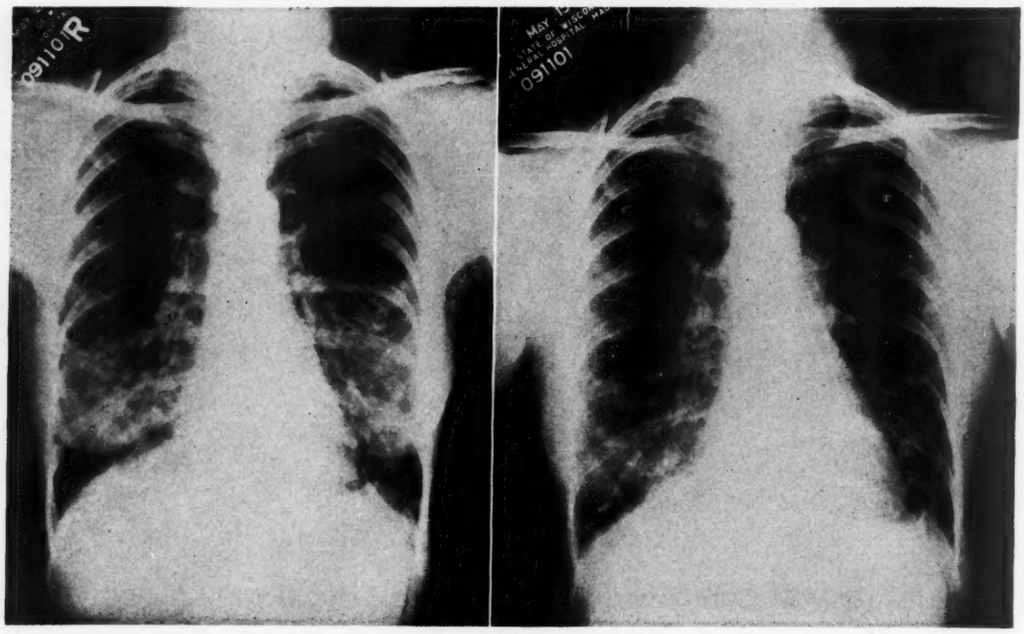
FIG. 1. *a*, Roentgenogram taken in August, 1939, before sterilization. Note destruction of tip of left scapula. *b*, Roentgenogram taken in April, 1940. Note recalcification of defect shown in Figure 1 *a*. (No local treatment given.)

COMMENT

In the first case sterilization resulted in calcification of nearly all bone lesions and

clearing up of the metastatic spread in both lung bases. While one may rightfully question the indirect effect of the withdrawal of the hormones as far as the metastatic foci in the pelvic bones are concerned, as they were partly in the field of irradiation, it does not seem plausible to use this argument in explaining the response of the lesions in the upper ribs, the scapula and in the lungs. As far as the symptomatic relief is concerned, it should be mentioned that on several occasions the medical consultant recorded on the history the "euphoria" of the patient which was in sharp contrast to the physical findings and spoke well for the palliative effect of sterilization alone without local irradiation.

In the second case the disappearance of the lung lesions as demonstrated in the roentgenograms and which took place without any direct exposure of the lungs can hardly be explained by any other mechanism than some endocrine reaction occurring in connection with the inactivation of the ovaries. The period of palliation lasting two years was remarkable and this observation confirmed by others constitutes a definite indication for sterilization in patients of this type. As to the age factor we believe that even in women below forty years castration is indicated if widespread skeletal or bilateral lung metastases are present. It seems to offer at least a chance of palliation and prolongation of useful life and this should well outbalance the discomfort due to the menopausal symptoms.



a *b*

FIG. 2. *a*, Roentgenogram of the chest taken in May, 1937, showing bilateral metastases in the lung bases. *b*, Roentgenogram of the chest taken in May, 1939; no evidence of metastases in the lung bases. (No local treatment given to either lung.)

SUMMARY

1. The effect of sterilization of the ovaries on metastatic carcinoma from a primary focus in the breast is briefly discussed.

2. Two illustrative cases, demonstrating the efficacy of this procedure, are reported.

3. Roentgen sterilization of all women, regardless of age, who have metastatic carcinoma from a primary carcinoma of the breast and of all women of forty

years or older as a prophylactic measure is recommended.

REFERENCES

1. Archer, W. Regression of carcinoma of the breast after artificial menopause. *Am. J. Roentgenol. & Rad. Ther.*, 44: 108, 1940.
2. Beatson, G. T. On the treatment of inoperable cases of carcinoma of the mamma: suggestions for a new method of treatment with illustrative cases. *Lancet*, 2: 104 and 162, 1896.
3. Dresser, R. Effect of ovarian irradiation on bone metastases of cancer of the breast. *Am. J. Roentgenol. & Rad. Ther.*, 35: 384, 1936.
4. Hunt, H. B. Regression of pulmonary metastases from mammary carcinoma following inactivation of ovaries by irradiation. *Radiology*, 34: 235, 1940.

Those postoperative wound and stitch abscesses (in operative treatment of fractures) which do occur are often made worse by surgical and dressing interference; the danger of dressing is usually greater than that of letting the patients alone, well immobilized and with wounds protected.
From—"Wounds and Fractures"—by Orr (Charles C. Thomas).

ILIOCOLIC INTUSSUSCEPTION*

DIAGNOSIS BY X-RAY WITHOUT CONTRAST MEDIA

JOSEPH LEVITIN, M.D.
SAN FRANCISCO, CALIFORNIA

THE diagnosis of intussusception of the bowel by means of an *x*-ray examination is a well known and long established procedure. Snow,[1] in 1913, was the first to report a case in which he confirmed a diagnosis of intussusception by use of a barium enema. In the same year appeared an article by Ladd,[2] in the following year one by Lehmann[3] and Groedel.[4] For an *x*-ray diagnosis a barium enema is advocated by the numerous authors, although some have been diagnosed by following the progress of the meal given by mouth. The appearance of the bowel, when the barium reaches the intussuscepted loop, has been well described and the types of intussusception have been classified.

Among the many papers on this subject are those by Sussman,[5] who reported four cases and gave an excellent summary of the types and causes, emphasizing the importance of studying the colon following defecation after barium enema, Shatzki[6] who added eleven cases to the accumulated literature and also analyzed the roentgen signs, and Kirsner and Miller[7] who emphasized the value of the postevacuation film and reviewed the entire subject.

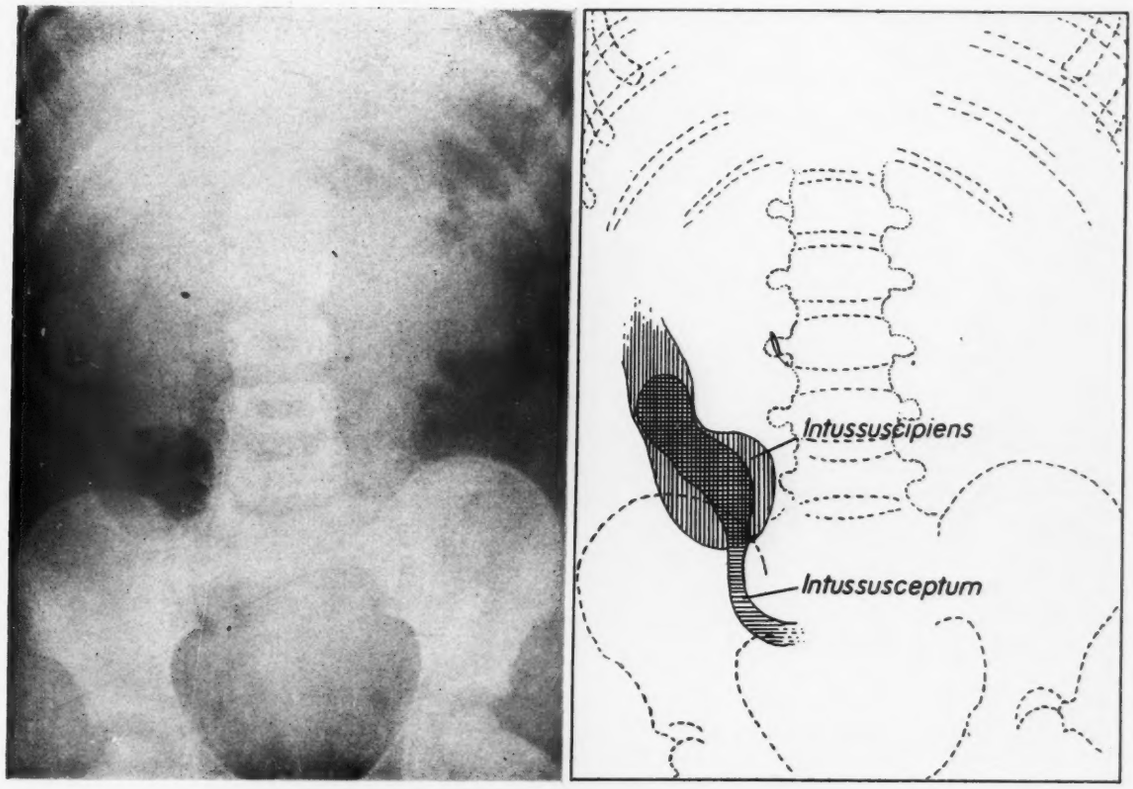
It is not the purpose of this paper to review the causes, types or criteria for diagnosis of intussuception. The reader is referred to the articles by the above mentioned authors and in addition to those of Wasch and Epstein,[8] Davis and Parker,[9] Ashbury,[10] Ochsner and Gatch.[11] All the above agree that a barium enema is an invaluable aid in diagnosis and describe the *x*-ray signs as an obstruction to the barium entering the colon with a filling defect. The head of the barium forms a cap and corresponds to the head of the intussusception; or, the barium may enter the sheath (intussuscepiens) surrounding the intussuscepted gut and a distended loop of bowel will be seen. The barium may trinkle through the intusscepted loop (intussusception) and show a string-like appearance which will be surrounded by the distended intussuscepiens. Barium has been used by the above authors either by enema or by mouth in establishing the *x*-ray diagnosis.

Most clinicians object to the use of barium by mouth in face of an intussusception with the possible mechanical obstruction. Some hesitate to use a barium enema. The purpose of writing this paper is to present two cases of ileocolic intussusception which were diagnosed on the flat film without the use of barium and to suggest that flat films be taken more often on suspected cases of intussusception.

It has been a popular procedure by members of the staff of the Mount Zion Hospital to refer most cases of suspected acute abdominal conditions for a flat plate of the abdomen (Brunn and Levitin).[12] Intussusception in children is not as common in our hospital as reported by other writers. We certainly cannot compare our few cases to the series of 400 cases reported by Koch and Oerum[12] and 100 reported by Hipsley.[14]

We are not original in taking a flat film for a suspected intussusception. Davis and Parker[9] mention that a flat roentgenogram was taken on one of their cases, but not sufficient evidence was there for a diagnosis and a barium enema was necessary. Shatzki[6] states that few facts have been published in regard to examination without contrast media and,

* From the Department of Roentgenology, Mount Zion Hospital, San Francisco.



A

B

FIG. 1. A, ileocolic intussusception; B, intussusception reduced by barium enema.

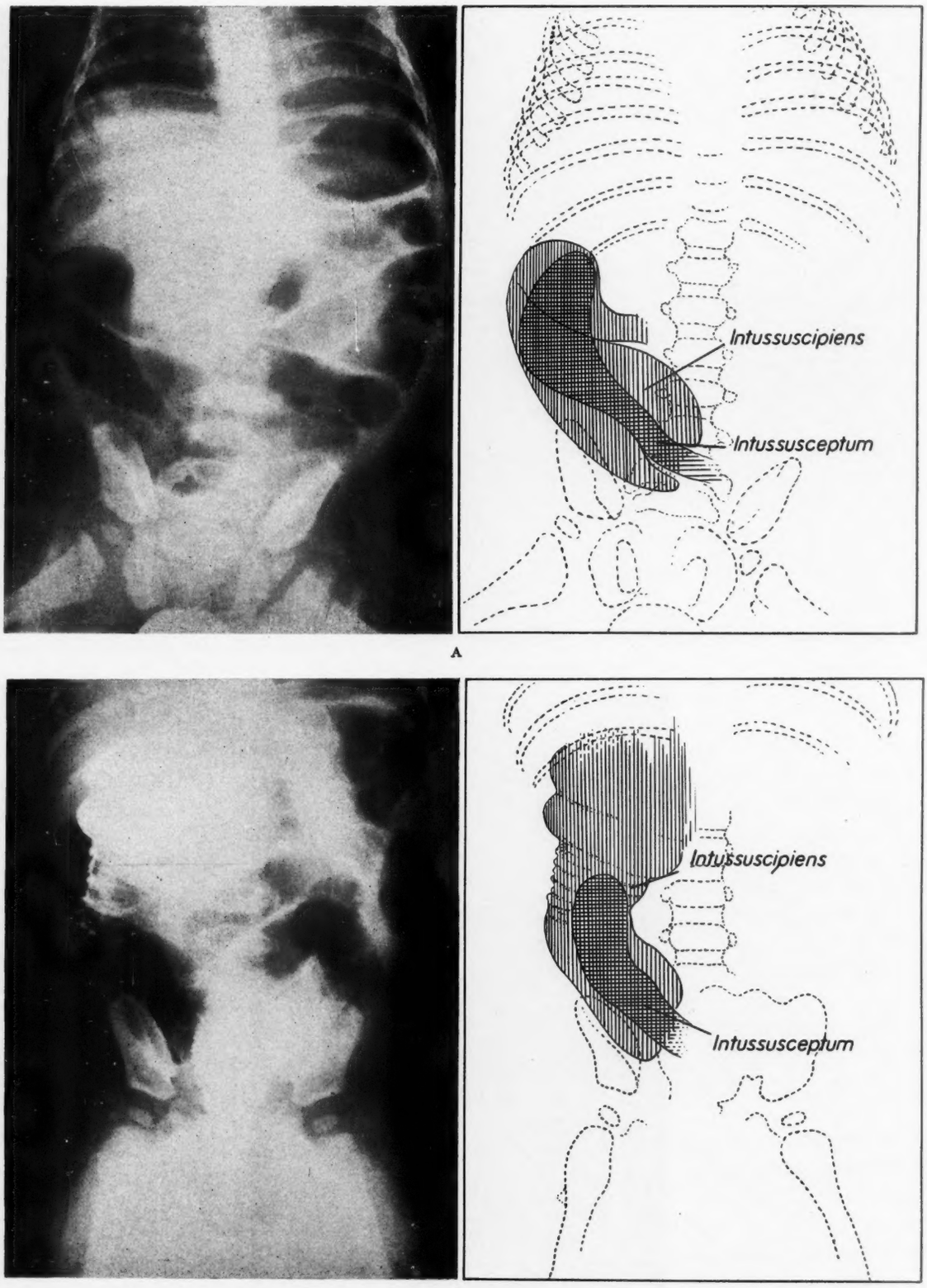


FIG. 2. A, ileocolic intussusception with small bowel dilatation; B, unsuccessful reduction of the intussusception. The barium has reached the top of the intussusception. The intussuscepiens has dilated at this point but the pressure of the barium is unable to disinvaginate the bowel.

although he had no cases to publish of his own, he proceeds to give the findings of an intussusception on the flat plate as: (1) Absence of a normal pattern of air in the cecum and ascending colon; (2) the area of intussusception has a sausage-shaped homogeneous shadow representing the intussuscepted portion of the intestine; (3) there may be air rings in the distended bowel surrounding the central shadow (intussuscepted gut); (4) if the central canal contains air, there will be a narrow air-filled lumen surrounded by a thick soft tissue cylinder.

Kloiber[15] emphasized the importance of finding a small bowel dilated with fluid, indicating evidence of a mechanical obstruction, but this does not necessarily imply an intussusception as the underlying cause.

In the two cases reported in this paper the findings were so typical that we wonder if they are not present more often but have been overlooked by not first taking the flat film. Both cases showed two loops of gas in the right lower quadrant, one within the other. The dilated intussuscepiens were readily recognized as cecum. Within this dilated loop was the second loop narrowed at its lower end, i.e., the neck of the intussusception. One case also had a dilated small bowel as the result of the mechanical obstruction produced by the intussusception. In both cases it was decided to try reduction by enema and as we wished to see if it was successful, a barium enema was given under fluoroscopic control.

The reduction of the intussuscepiens by enema antedated the *x*-ray diagnosis. The largest series reported was from Denmark by Koch and Oerum[13] in 1912. Four hundred cases were reported, all treated by enema. The patients were under anesthesia which allowed for more relaxation and made it possible for the surgeon to massage against the direction of the intussusception. They reported only fifteen failures to disinvaginate out of the 400 cases. This procedure was first suggested by Hirschprung.[16] Hipsley,[14] in 1925, analyzed 100 cases in which sixty-two cases were completely reduced by enema with a mortality of 5 per cent. This is in contrast to a surgical mortality of 6.6 per cent reported by Wilfred Vickers.[17] Since then successful reductions of intussusception under fluoroscopic control have been reported by Retan[18] and Stephens.[19] In our two cases we were successful in reducing one. The other case in which the symptoms had been present for five days had to go to surgery. Both patients have since been well.

Case I. L. C., a male age three years, was a healthy child with no unusual history until three A.M. when out of a sleep he was seized with a sharp pain, doubling him up. The pain seemed to occur every ten minutes for a duration of about one minute. During the intervals he was free of pain and comfortable. One hour later he had a loose bowel movement. No gross blood was seen. At 8:00 A.M. he vomited. The patient had an *x*-ray examination at 10:00 A.M. (seven hours after onset) on entering the hospital. The white blood count at entry was 11,000 with 52 per cent P.M.N. *X*-ray examination (Fig. 1 A) showed a distended loop of gas in the right lower quadrant corresponding to the cecum, within this loop was a second distended loop, narrowed at the entrance into the cecum. An *x*-ray diagnosis was made of an ileocolic intussusception. A barium enema was given to see if the intussusception could be reduced under fluoroscopic control. The barium entered slowly without difficulty until it reached the head of the intussuscepted loop of bowel. There was a delay with further dilatation of the ascending colon (intussuscepiens). At this point the child complained of considerable pain. Following this there was a sudden release of the barium into the cecum and an overflow into the terminal ileum. The intussusception was reduced. (Fig. 1, B.) The child has remained well. With the expulsion of the enema there was some blood; this being the first time blood was found in the stool.

Case II. An infant girl six months old, with nothing unusual in her past history until three days prior to entry had intestinal colic. On the day of entry the child had considerable pain

and there was a palpable mass in the right lower quadrant. White blood count was 7,900 P.M.N. 22 per cent. An *x*-ray of the abdomen showed a distended loop of bowel in the right lower quadrant within which was a smaller loop of bowel with a narrowed neck. The remaining small bowel was distended with gas. (Fig. 2 A.) The case was diagnosed as an ileocolic intussusception with a small bowel mechanical obstruction. Although Retan[18] believes that a successful reduction by barium enema must take place in the first twelve hours and this patient had already gone four days, nevertheless, a barium enema was given under fluoroscopic control. The fluid entered without difficulty until it reached the head of the intussusceptum. (Fig. 2 B.) At this point, however, the child had considerable discomfort and expelled the enema and tube. The attempt to reduce the intussusception having proved unsuccessful the child was taken to surgery. On opening the abdomen the diagnosis of ileocolic intussusception with small bowel obstruction was confirmed. The intussusception was carefully reduced and the child made an uneventful recovery.

CONCLUSIONS

1. A flat film of the abdomen may give necessary diagnostic clue to a diagnosis of ileocolic intussusception.

2. The findings consist of a gas distended loop within which may be found a smaller loop with a narrowed neck.

3. Reduction of the intussusception by barium enema may be successful if done early.*

* Since this paper was written an article on the same subject has appeared by Abrams, Hyman S. Intussusception. Particular reference to roentgen diagnosis without opaque media. *Radiology*, 36: 490–492, 1941.

REFERENCES

1. Snow, J. M. and Clinton, M. The diagnosis of intussusception by the x-ray. *Am. J. Dis. Child.*, 6: 93, 1913.
2. Ladd, W. E. Progress in diagnosis and treatment of intussusception. *Boston M. & Surg. J.*, 168: 542–544, 1913.
3. Lehmann, C. Quoted by Kirsner and Miller. The roentgen diagnosis of intussusception. *Radiology*, 31: 658–659, 1938.
4. Groedel, F. M. Quoted by Kirsner and Miller. *Radiology*, 31: 658–668, 1918.
5. Sussman, M. L. Roentgenologic aspects of subacute and chronic intestinal intussusception. *Am. J. Roentgenol. & Rad. Therapy*, 27: 373–382, 1932.
6. Shatzki, R. Intussuscepted tumors of the colon. *Am. J. Roentgenol. & Rad. Therapy*, 41: 549–563, 1939.
7. Kirsner, J. B. and Miller, J. F. The roentgen diagnosis of intussusception. *Radiology*, 31: 658–659, 1938.
8. Wasch, M. G. and Epstein, B. S. Chronic recurrant intestinal intussusception. *Radiology*, 33: 316–324, 1939.
9. Davis, K. S. and Parker, C. Intussusception, its roentgenographic diagnosis. *California & West. Med.*, 31: 330–335, 1929.
10. Ashbury, H. E. Roentgenological aspect of intussusception. *Am. J. Roentgenol.*, vol. 18, no. 6, 1927.
11. Ochsner, M. C. and Gatch, W. D. Intussusception in the adult. *Am. J. Roentgenol.*, 42: 276, 1929.
12. Brunn, M. and Levitin, J. A roentgenological study of intestinal obstruction. Accepted for publication October, 1939, *Surg., Gynec. & Obst.*
13. Koch, A. and Oerum, H. P. T. *Edinburgh M. J.*, p. 238, 1912.
14. Hipsley, P. L. Intussusception and its treatment by hydrostatic pressure. *Med. J. Australia*, 2: 201, 1926.
15. Kloiber, H. Quoted by Shatzki. Intussuscepted tumors of the colon. *Am. J. Roentgenol.*, 41: 549–563, 1939.
16. Hirschprung. Quoted by Koch and Oerum. *Edinburgh M. J.*, p. 238, 1912.
17. Vickers, Wilfred. Diagnosis of intussusception. *Med. J. Australia*, p. 206, 1926.
18. Retan, G. Non-operative treatment of intussusception. *Am. J. Dis. Child.*, 33: 765–770, 1927.
19. Stephens, V. R. Acute intussusception. Manipulative reduction under fluoroscopic control. *Am. J. Dis. Child.*, 35: 61–64, 1938.

MENTAL DISORDERS ASSOCIATED WITH HYPERTHYROIDISM

ELBERT T. RULISON, JR., M.D.,
Resident House Officer, Highland Hospital

JOHN D. WHITE, M.D.
Resident House Officer, Highland Hospital

AND

LEONARD K. STALKER, M.D.
On Surgical Staff, Highland Hospital

ROCHESTER, NEW YORK

PSYCHOSIS is not a common complication of hyperthyroidism. Johnson reported only twenty-four instances of psychosis in 2,000 patients with hyperthyroidism. Foss and Jackson studied 800 patients with hyperthyroidism and found evidence of mental disorder in two cases. Conversely, a goiter was present in fifty of 1,700 psychotic patients studied. Parker states that less than 2 per cent of patients with exophthalmic goiter present evidence of mental derangement. In view of the rather infrequent association of these two conditions and because of the unusual results obtained, we felt justified in presenting our case and discussing the nature and relationship of this association in general.

A variance of opinion has been expressed regarding the rôle of the thyroid as an etiological factor in the production of psychosis. Hammes believes that psychoses encountered with thyrotoxicosis can be classified with, and have the usual characteristics of, ordinary psychoses. He considers the hyperthyroidism an associated rather than etiologic condition. On the other hand, Walker considers the thyrotoxicosis as etiological. Katzenelbogen and Luton believed that the thyroid dysfunction was a precipitating or aggravating factor in their cases.

Thyroid malfunction is accompanied by deviations from the average normal mental and motor activity; as for example, retardation is a concomittant of myxedema and cretinism, and mental and motor overactivity with hyperthyroidism. If this is true, one would expect some possible etiologic relationship between thyroid disease and psychoses in certain cases. Hyperthyroidism, however, has not been associated with any one type of psychosis. In Jameson and Wall's series each case exhibited a different psychological response and psychotic manifestation. They believed that given a favorable background, including familial and personality propensities, and such factors as prolonged physical and emotional stress that a latent thyroid disease might be precipitated with an associated psychosis of any type.

Dunlap and Moersch classified their cases according to the psychic manifestations and the thyroid pathological condition present. The predominant types of mental reactions were (1) toxic exhaustion, (2) acute delirium, and (3) manic-depressive psychosis, 91 per cent of the series being made up of the first two groups.

Toxic exhaustive psychoses were present only in cases of thyrotoxicosis, due to either exophthalmic or adenomatous goiter. The majority gave a relatively short history of mental disturbance and under medical care showed marked and rapid improvement. Acute delirium, likewise, was seen only in association with hyperthyroid states. The terms acute delirium, thyroid crisis, hyperthyroid reaction and thyroid storm are used to designate more or less the same condition. These cases are regarded as presenting the one possible definite relationship between hyperthyroidism and mental disturbances, for no instance of familial history of psychosis or of a previous mental disturbance occurred in this group.

All these patients presented a severe degree of hyperthyroidism, but the severity of the hyperthyroidism was found to be no index to the severity of the mental reaction.

Typical acute delirium, or thyroid crisis, is seen infrequently since the introduction of compound solution of iodine in the treatment of thyrotoxicosis. When it occurs, however, the psychosis is in proportion to the severity of the hyperthyroid reaction and disappears when the crisis is controlled.

The manic-depressive cases made up the third most common group in Dunlap and Moersch's series. Since this psychosis is found complicating cases of goiter without hyperfunction, as well as those with thyrotoxicosis, the hyperthyroidism cannot be considered responsible for the development of the manic-depressive reaction. We have seen an interesting case of hyperthyroidism which was complicated by the development of a mental disorder.

CASE REPORT

A fifty-one year old white, married woman was admitted to the hospital with a chief complaint of nervousness and increasing weakness of one year's duration. One year prior to admission, because of increasing asthenia, nervousness, irritability, tremor, crying spells, increased appetite and diaphoresis, the patient consulted her physician. Two months prior to her admission she developed edema of the ankles, dyspnea on moderate exertion, orthopnea and a nonproductive cough. Ten days before admission she was told that her heart was "beating 200 beats too fast" and was confined to bed. She had lost eighty pounds in weight during the last three years.

Her past history was essentially negative. Physical examination revealed an undernourished woman who was alert, co-operative but very apprehensive and nervous. The blood pressure was 165 mm. of mercury systolic, and 85 mm. of mercury diastolic. The pulse rate was 136 beats per minute and respiration 28 per minute. Moderate exophthalmous and slight lid lag were present. The thyroid was diffusely enlarged to a size approximately six to eight times normal. A bruit was present over both lobes. The heart was enlarged to the left and a faint apical systolic murmur was present. There was pitting edema of the ankles and muscular strength of the extremities was poor. A marked tremor of the hands was present.

Urinalysis showed a moderate amount of albumin. The concentration of nonprotein nitrogen was within normal limits and the blood cholesterol 118 mg. per cent. Hemoglobin was 72 per cent, leukocyte count 5,200, and erythrocyte count 4,710,000 per cubic millimeter of blood. The serologic reaction for syphilis was negative. Basal metabolic rate was plus 69 per cent.

Roentgenographic examination of the chest showed a widening of the aortic arch and slight cardiac enlargement. An electrocardiogram revealed nothing unusual.

The patient responded poorly to the usual methods of preoperative preparation and for this reason was given two treatments with *x*-ray at five week intervals. She showed some improvement, and on her fifty-third hospital day, three weeks following the first *x*-ray treatment, the basal metabolism rate was plus 40 per cent and she had gained five pounds. Despite the general improvement, surgery was delayed because of the presence of an acute follicular tonsillitis.

During the hospital stay the patient's mental status showed gradual deterioration, so that by the sixty-sixth day doubt was expressed as to the advisability of, or benefit to be expected from, thyroidectomy. She was disoriented as to time, place, and person, and showed in general marked motor depression. She wept when spoken to and could not remember her visitors from day to day. She exhibited occasional delusions and hallucinations, hearing or seeing people outside her room who had come to kill her or to take her to the operating room. For transient periods her orientation and general mental reaction seemed improved. These episodes were usually associated with some improvement in the general toxic status as indicated by lowering and steadying of her pulse and temperature levels.

We assumed care of this patient on her seventy-ninth hospital day and after consultation with her previous physicians decided that a more radical program must be instituted. Consequently, after two weeks of vigorous preparation, thyroidectomy was performed. Pathological examination confirmed the clinical diagnosis of exophthalmic goiter. The patient made an uncomplicated convalescence and by

the fifth postoperative day was walking about, was well oriented and conversed rationally. She was dismissed from the hospital ten days following the operation.

Three months following the operation the patient had gained thirty pounds, was doing her own housework and manifested no evidence of mental disturbance. Nine months following operation she had gained fifty pounds and was in the best of health.

COMMENT

We believe that this patient had marked hyperthyroidism due to an exophthalmic goiter and in addition developed a toxic exhaustive type of psychosis. The increase in the toxic and psychotic symptoms, in spite of adequate medical care, was unusual. It is possible that the tonsillitis and the consequent foci of infection aggravated this condition. The most unusual feature presented by this case is the fact that the psychosis of this severity cleared following thyroidectomy. It was our opinion, and this was substantiated by discussion with Pemberton, that it is very unusual for such a patient to be materially improved from the mental viewpoint following control of the hyperthyroidism. On the other hand, occasionally the psychotic symptoms of a shorter duration, and usually those associated with a crisis of the disease, disappear with control of the thyroid hyperfunction. Certainly one should not consider the presence of a mental condition a definite contraindication to surgery, and in selected cases indicated surgery is advised.

SUMMARY

Hyperthyroidism is not specifically associated with one type of psychosis. Toxic exhaustive reactions and acute delirium are probably the most common mental disturbances complicating thyroid hyperfunction. The content of the psychoses does not differ essentially from that of similar types of psychoses in individuals without hyperthyroidism. When a psychosis occurs in the presence of hyperthyroidism it should not be considered a definite contraindication to surgery. The prognosis of the psychosis probably depends upon the ratio of thyroid toxicity to the underlying mental instability of the patient.

REFERENCES

1. Dunlap, H. F. and Moersch, F. P. Psychic manifestations associated with hyperthyroidism. *Am. J. Psychiat.*, 91: 1215, 1935.
2. Foss, H. L. and Jackson, J. A. The relationship of goiter to mental disorders. *Am. J. M. Sc.*, 167: 724, 1924.
3. Hammes, E. M. Neuropsychiatric disorders and hyperthyroidism. *Journal-Lancet*, 48: 43, 1928.
4. Jameison, G. R. and Wall, J. H. Psychoses associated with hyperthyroidism. *Psychiat. Quart.*, 10: 464, 1936.
5. Johnson, W. O. Psychosis and hyperthyroidism. *J. Nerv. & Ment. Dis.*, 67: 558, 1928.
6. Katzenelbogen, S. and Luton, F. H. Hyperthyroidism and psychobiological reactions. *Am. J. Psychiat.*, 91: 969, 1935.
7. Parker, R. M. Disastrous possibilities in thyroidectomy. *Illinois M. J.*, 33: 317, 1918.
8. Pemberton, John deJ. Personal communication to the author, 1941.
9. Walker, W. K. Hyperthyroidism and mental disorders. *New York State J. Med.*, 107: 391, 1918.

PERITONEOSCOPY VERSUS EXPLORATORY LAPAROTOMY

A COMPARISON OF MORBIDITY AND MORTALITY

BOARDMAN M. BOSWORTH, M.D.
Assistant Visiting Surgeon, City Hospital
NEW YORK, NEW YORK

THERE still appears to be great divergence of opinion in the profession with regard to the value of peritoneoscopy as a diagnostic procedure. It has not as yet been accorded that measure of general popularity which it deserves, as a safe and effective method of surgical investigation in selected cases. Perhaps this is largely the fault of its advocates, who publicize its simplicity of technic but often omit detailed statistics of end results from which alone its value can fairly be judged.

It is a well established surgical principle that the advantages claimed for any new procedure must be considered in relation to the operative morbidity and mortality associated with it. This is of deep concern not only to the doctor and the hospital but, above all, to the patient.

With this in mind, the end results have been carefully reviewed in a consecutive series of cases of basically similar nature, subjected to diagnostic exploration by peritoneoscopy or laparotomy during the year April 1, 1939 to March 31, 1940, at the City Hospital, New York. For the purpose of a fair comparison of these two procedures, only those cases have been included in which there were good clinical grounds for suspicion of serious liver involvement but in which it was impossible to differentiate, with reasonable certitude, between two or more of the following diagnoses: carcinoma, cirrhosis, amyloidosis, lues, tuberculosis, hepatitis or biliary tract disease. This group of cases was selected for analysis because it contained the greatest number of patients presenting similar clinical pictures, subjected to exploratory laparotomy or peritoneoscopy.

The series is small but significant. Thirteen such patients were operated upon, seven by exploratory laparotomy and six by peritoneoscopy. Seven different surgeons performed the laparotomies. All the peritoneoscopies were done by the author. All of the patients in both groups were poor surgical risks, but in each case it was believed that the patient deserved the benefit of a diagnostic operation, all more conservative modes of investigation having failed.

Of the seven patients subjected to exploratory laparotomy, a definite diagnosis was made in every case, but five of them died as a result of the operation within two weeks, an operative mortality of 71 per cent. (Table 1.) One patient expired on the third postoperative day, two on the seventh, one on the tenth and one on the fourteenth. The operative morbidity was also impressively high. (Table 1.) Five patients ran a temperature of 101°F. or over for varying lengths of time following operation. There were two cases of wound disruption, one of which completely eviscerated. Two patients showed a severe grade of pulmonary edema; one developed a terminal bronchopneumonia and one died with an acute diffuse peritonitis, proved at autopsy.

In the series of cases peritoneoscoped there were no operative deaths, nor were any postoperative complications encountered. In four of these six patients a definite diagnosis was made, based upon examination of biopsy material. In one of the two cases in which a diagnosis was not made, examination was unsatisfactory due to omental adhesions; in the other, the

electrocautery unit failed during the procedure and no biopsy was taken.

A brief outline of two typical cases, one explored by laparotomy and one by peritoneoscopy, will prove of interest.

TABLE I

COMPARATIVE ANALYSIS OF MORBIDITY AND MORTALITY

	No. of Cases	Postoperative Diagnosis	Postoperative Complications	Deaths Due to Operation	Mortality Per Cent
Exploratory laparotomy.....	7	Carcinoma 3 Cirrhosis 3 Amyloidosis 1	Fever (101°F. or over) 5 Wound disruption 2 Pulmonary edema 2 Pneumonia 1 Peritonitis 1	5	71
Peritoneoscopy.....	6	Carcinoma 2 Cirrhosis 1 Chronic hepatitis 1 Undiagnosed 2	None	None	None

Case I. A sixty-three year old colored male gave a history of recurrent, vague right upper quadrant distress for one year before admission to the hospital. There were occasional nausea and vomiting with a question of recent jaundice and weight loss. His symptoms had been increasing. The past history included chronic alcoholism and an untreated lues. Examination disclosed a chronically ill emaciated negro in no acute distress. The skin was dehydrated, the abdomen scaphoid and the liver enlarged to the umbilicus with a hard, irregular, nontender edge. A tentative diagnosis of cholecystitis and cholelithiasis was made. At exploratory laparotomy the right lobe of the liver was found to be greatly enlarged. Multiple hard white nodules were scattered throughout both lobes of the liver and in the omentum. The stomach, pancreas, prostate and bowel were palpated and found to be negative. Postoperative diagnosis was metastatic carcinoma, primary site unknown. The patient's temperature began to spike to 103 to 104°F. following operation and he expired on the seventh day with signs of bronchopneumonia.

Case II. A fifty-nine year old Italian laborer complained of loss of weight and strength for five years, with intermittent epigastric for six months. During the four or five weeks prior to admission he had been jaundiced and had suffered from attacks of nausea and vomiting. The past history was essentially negative. Examination revealed an emaciated, jaundiced male of fifty-nine years who did not seem to be acutely ill. The liver was enlarged well below the costal margin; its edge was firm and tender. It was questionable whether a mass could be felt in the epigastrium. A preoperative diagnosis of metastatic carcinoma of the liver was made. At peritoneoscopy the liver was seen to be slate-grey in color. It was smooth and rather hard. Its upper surface was studded with tiny, yellowish, slightly raised, cyst-like nodules which ruptured easily, discharging a little serous fluid. A large, stony-hard irregular mass was found in the omentum. Six ounces of clear bile-stained fluid were aspirated from the peritoneal cavity. A biopsy of the liver was obtained through the peritoneoscope. This was reported to be a metastatic adenocarcinoma of the liver. No primary lesion was found on peritoneoscopy. The patient's immediate postoperative condition remained unchanged. Temperature, pulse and respiration were unaffected. The wound healed per primam. However, the patient slowly wasted away and died one month later. Autopsy disclosed a carcinoma of the head of the pancreas with extensive metastases to the liver and omentum.

The large margin of error possible in drawing precise conclusions from such a small series of cases is fully appreciated. Perhaps in a larger group the mortality in exploratory laparotomies in these poor risk patients would not be as high as 71 per cent. But reported fatalities following

peritoneoscopy are rare. That this should be so is not surprising when one compares the magnitude of the two operations.

Peritoneoscopy actually amounts to little more than a paracentesis and is performed in much the same way except that it is surrounded with greater precautions for the safety of the patient. It is performed in the operating room and the patient is so prepared that an immediate laparotomy is possible in the event of any emergency. In the author's experience this has never been required. The operation is done under local anesthesia through a stab wound so small that it is easily closed by a single skin clip. The patient may be out of bed and even return home the same day.

Exploratory laparotomy, on the other hand, requires a major abdominal incision and usually a general anesthesia. It is attended by a certain amount of shock due to unavoidable manipulation of the viscera. There is more or less postoperative reaction and a hospital convalescence of a week or longer must be contemplated. Added to this of course are the possible complications which may attend any laparotomy, chief among which are pulmonary edema, pneumonia and wound disruption. As has been seen, all these complications were encountered among the laparotomies included in this report.

SUMMARY

A comparative review of the end results in a series of consecutive cases subjected to exploratory laparotomy and to peritoneoscopy, for diagnostic purposes, is presented.

From the standpoint of morbidity and mortality, peritoneoscopy is a safer procedure than exploratory laparotomy and it compares favorably with the latter as a diagnostic procedure in selected cases.

New Instruments

AN ELECTRIC BONE SAW AND DRILL*

J. Vernon Luck, M.D.
Instructor in Orthopedic Surgery, University of Southern California Medical School
LOS ANGELES, CALIFORNIA

IT is as it should be that electrically operated bone surgery instruments are becoming increasingly popular. However, the complexity of the majority of electric bone surgery sets discourages many surgeons from making as frequent use of these instruments as perhaps they should. The instrument to be described has simplicity in its favor.

Each end of the motor unit (Fig. 1A) is represented by a chuck, on one end a standard Jacob's chuck which operates at 2,200 rotations per minute, and on the opposite end a smaller chuck which operates at the unusually high speed of 13,000 rotations per minute. The latter chuck represents a unique feature in that it activates minute burrs which, by virtue of the high speed at which they are rotated, become surprisingly effective bone cutting tools. These burrs (Fig. 1F) which resemble tiny drills, are used in several sizes, but the size most frequently employed has a cutting portion ¼ inch long and 1/32 inch in diameter. When rotated at speeds above 10,000 rotations per minute these small caliber burrs cut bone like a saw; at speeds below 10,000 rotations per minute they function merely as a drill. After a little experience, the direction of the cut in the bone may be altered as frequently and as acutely as the case requires. (Fig. 2.)

TECHNIC

The technique for using sawing-burrs is as follows: (1) Burr must be operated at full speed and the foot rheostat kept fully depressed. (2) To begin the cut the burr is drilled vertically into the bone, using care to prevent penetration of the burr deeper than its cutting portion. With the burr held in a near vertical position it is drawn firmly along toward the operator. (3) When cutting bone that is thicker than the length of the burr, it is necessary to make succeeding

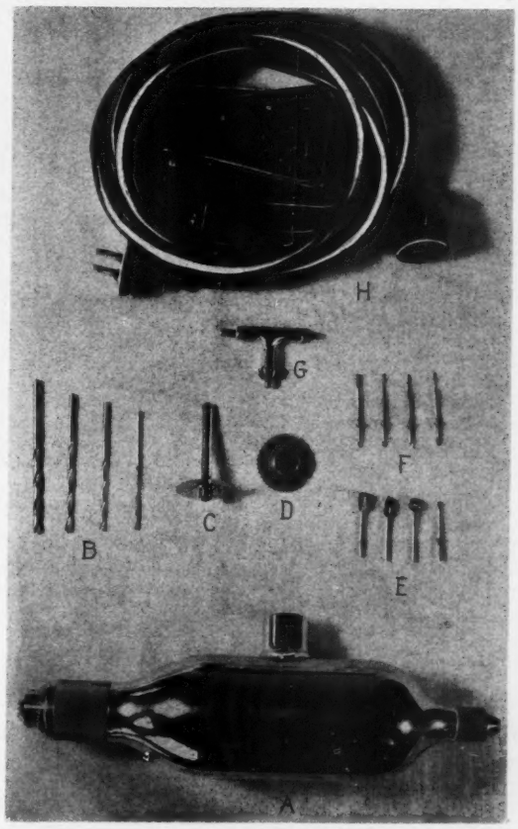


FIG. 1. A, motor unit; B, machinist's twist drills; C, circular saw and mandrel; D, twin saw blade; E, curetting burrs; F, bone cutting burrs; G, key wrench for adjusting Jacob's chuck and circular saws; H, foot rheostat and electric cord.

* From the Department of Orthopedic Surgery, State University of Iowa, Iowa City, Iowa. Service of Dr. Arthur Steindler.

cuts in the same slot until the full thickness of the bone is penetrated. (4) Saline should be used if the burr generates heat, and may be applied effectively with a syringe and hypodermic needle. (5) If the cutting surface of the burr becomes clogged, it becomes ineffective and should be scraped clean. (6) Both straight and complex cuts may be made with more accuracy if made along lines drawn on the bone, or along the edges of a pattern.

The uses of the sawing burr are (1) cutting bone grafts of irregular contour; (2) making transverse end cuts in removing tibial or other bone grafts, after the longitudinal cuts have been made with the circular saws; (3) osteotomies, especially of smaller bones; (4) removal of cortical windows in acute osteomyelitis; (5) cutting bone grafts or flaps from the ilium; (6) skull plastics; and (7) laminectomies.

Jacob's Chuck. (Adjusted by key wrench, Figure 1G.) Through the interposition of 6 to 1 helical gears, a Jacob's chuck on the end of the motor unit opposite the high speed chuck activates the following at a maximum speed of 2,200 rotations per minute:

Circular Saws. (Fig. 1C and D.) The second, or twin blade, may be adjusted accurately by a set screw for the width of cut desired. For a single cut the second blade is slipped off the mandrel merely by loosening the set screw. Handle tips of the same key wrench (Fig. 1G) which adjusts the Jacob's chuck, serve to adjust the set screws of both circular saws. In using the circular saws the blades are applied gently

FIG. 2.

FIG. 3.

FIG. 2. Shows use of small caliber cutting burr in making irregular or curving cuts in bone. By rotating at 13,000 r.p.m. the burr is transformed into a cutting tool.

FIG. 3. Shows twin saws in use. They rotate at 2,200 r.p.m., have abundant power, do not jam, and do not burn the bone.

to the bone and held at one point until they penetrate the desired depth. Holding the motor unit firmly, the saws are then moved along from right to left. (Fig. 3.)

Twist Drills. (Fig. 1B.) Standard twist drills up to ¼ inch in diameter may be used in the Jacob's chuck. Larger size drills may be used if their bases are adapted to the ¼ inch capacity of the chuck.

Curetting Burrs. (Fig. 1E.) These burrs frequently are useful in saucerizing a chronic osteomyelitis, curetting bone cysts and treating fracture fragments in pseudarthroses.

Kirschner Wires. Such wires are readily inserted. A special stabilizing mechanism to render them rigid is unnecessary. During insertion the wire may be made adequately rigid by holding it in its middle between towel-covered tips of the thumb and index finger.

Steinman Pins. Any size Steinman pin will fit into the chuck. Since the motor unit has abundant power at low speeds, pins or wires may be inserted without fear of heating the bone.

Sterilization. The entire motor unit together with a segment of the electric cord that connects the motor unit with the foot rheostat are sterilized in the autoclave for twenty minutes under thirty pounds pressure. Sterilization is best carried out several hours before the instrument is to be used to give it an opportunity to cool. However, in an emergency it may be cooled in fifteen minutes by wrapping it in a towel and thoroughly saturating the latter with alcohol or ether. The feasibility of constructing a closed motor unit capable of withstanding autoclave sterilization was first demonstrated by Cox.* This method was adopted and has some advantages over separately sterilizable Hartley-Kenyon shells employed in the Albee and the Kreuscher bone saws. Assembly of the motor into the shells adds to the complexity of the unit, and in some hands adds a danger of contamination.

Construction. The electric motor is universal and operates on 110 volts alternating or direct current. After considerable searching to find a dependable heat resisting insulation for the wire used in the electric motor, a new type of glass insulation was found and employed. Even during profound experimental abuse there were no instances of impairment of the insulation. Both metal and nonmetal gears were used; the combination was found to be quieter and more efficient. Special grease-tight, vapor-proof bearings were employed to prevent the escape of lubricant and the entrance of steam. During two hundred autoclave sterilizations no grease leaked out and no detectable steam entered the casing. Gears and bearings are packed in heat resisting grease which supplies lubrication for the life of the motor unit. This feature removes the inconvenience of periodic lubrication. A streamlined duraluminum case incloses motor, gears and bearings. A waterproof electric connection sets in the middle of the case to receive the plug of the electric cord. Speed of the motor is controlled by a foot rheostat. (Fig. 1H.) Length of the motor unit is 10½ inches, greatest diameter 2½ inches, weight 3½ pounds.

* *J. Bone & Joint Surg.*, 21: 1048, 1939.

APPENDECTOMY WITH A MODIFIED FURNISS CLAMP

ARTHUR BOWEN, M.D.

Associate Senior Surgeon, Cedars of Lebanon Hospital; Assistant Clinical Professor of Surgery, College of Medical Evangelists

LOS ANGELES, CALIFORNIA

WITHIN the last decade numerous appliances have been devised to deal with the operative procedures on the gastrointestinal tract, with the object of facilitating technically the removal of pathology with a minimum of trauma and contamination.

The original Furniss clamp has been modified by Clute and McClure to facilitate aseptic closure of the duodenal stump in gastric resection. It occurred to the writer that if these modifications were applicable to the duodenal stump, it certainly could be equally applicable in the most commonly performed enterectomy —appendectomy. The complications of hemorrhage, contamination and leakage in appendectomy are to be avoided as carefully as in duodenal stump closure.

The illustrated clamp is a modification of the Furniss clamp with the handles angulated so as to permit its application in the depths of the abdominal wound, when the cecum is fixed and cannot be delivered. The application of the clamp crushes, shirrs and automatically sews the cecal base. One cannot be dogmatic as to the treatment of the appendiceal stump. Experienced surgeons have expressed their views pro and con ligation and inversion. *Simple ligation* is stated to be dangerous because of the possibility of the stump "blowing out." *Ligation and inversion* is condemned by others because the ligated stump is buried in a closed cavity which may result in a localized residual abscess or generalized peritonitis. *Inversion without ligation* is considered to be surgically sound since the stump is inverted into the cecal lumen and is not buried within the cecal wall. The late C. H. Mayo gave four reasons why he did not invert the stump: "(1) Invariably, in cases in which appendectomy with inversion of the stump has been done in combination with some other surgical procedure and death has resulted, there is a pus pocket in the inverted stump up to twenty-one days post-operatively; (2) the cultured suture material used to invert the stump, once having run thru the intestinal wall, invariably is infected with pathogenic bacteria; (3) non-inversion shortens the surgical procedure; and (4) I have not had occasion to regret not having inverted the stump."

The writer leaves the treatment of the stump to the good judgment of the individual surgeon, the designed appendectomy clamp permitting either ligation, inversion or both. When the clamp is applied, the cecal base is crushed and shirred. An atraumatic straight intestinal needle is then inserted in the distal or proximal groove and pushed through the crushed base. (Fig. 1A.) The appendix is amputated by knife or cautery and the suture drawn through. (Fig. 1B.) When the clamp is removed, the stump is crushed, shirred and its walls automatically sewn. (Fig. 1C.) At this point the surgeon may simply ligate (Fig. 1D) or may continue the original suture as a seromuscular suture to peritonealize the stump. (Fig. 1E.) For those who choose to invert the stump without ligation, the technic is very simply modified by inserting a pin instead of the straight intestinal needle in the step illustrated in Figure 1A. When the clamp is removed, the cecal base is shirred and temporarily pinned together. A right angle

Cushing stitch is placed and at its completion the pin is removed, inverting the crushed but not ligated stump into the cecal wall. While the same right angle suture may be placed over any toothed crushing clamp, the serrated crushing clamp has to be wiggled and maneuvered considerably from under the suture, favoring leakage and contamination.

I believe that the ease with which this modified clamp may be applied to simplify the treatment of the appendiceal stump may merit its addition to the surgeon's armamentarium.

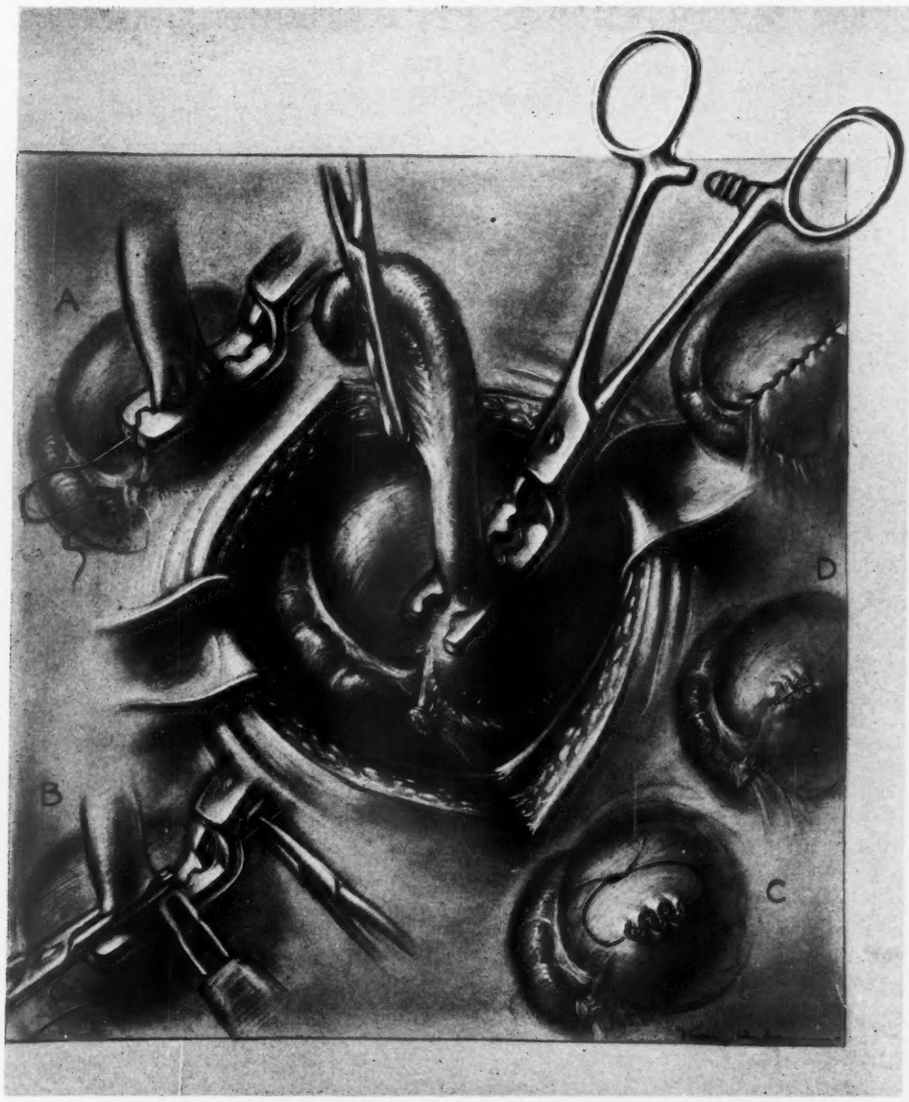


Fig. 1. Illustration showing application of the Furniss clamp as modified by the author in appendectomy. A, an atraumatic straight intestinal needle is inserted at the distal end of the clamp groove, and pushed through the crushed and shirred appendiceal base. B, a crushing clamp placed proximal to appendiceal clamp and appendix amputated with cautery. C, shows the clamp removed, the suture having been drawn through, leaving the cecal base crushed, shirred and sewn together, permitting the surgeon to deal with the stump as he chooses, either tying it (D) or peritonealizing it by a right angle Cushing seromuscular stitch E.

DOYEN TUMOR SCREW

FURNISS MODIFICATION

H. D. Furniss, M.D.
NEW YORK, NEW YORK

THE Doyen tumor screw is a useful instrument, especially in operations for uterine fibroids. However, when the screw pierces a large blood vessel, as occasionally happens, free bleeding may result. To obviate such bleeding the Doyen screw has been modified as herewith described and illustrated.

The cup, on the shank of the instrument, compresses the tissue around the shank as the instrument is screwed into the growth, thus preventing escape of blood.

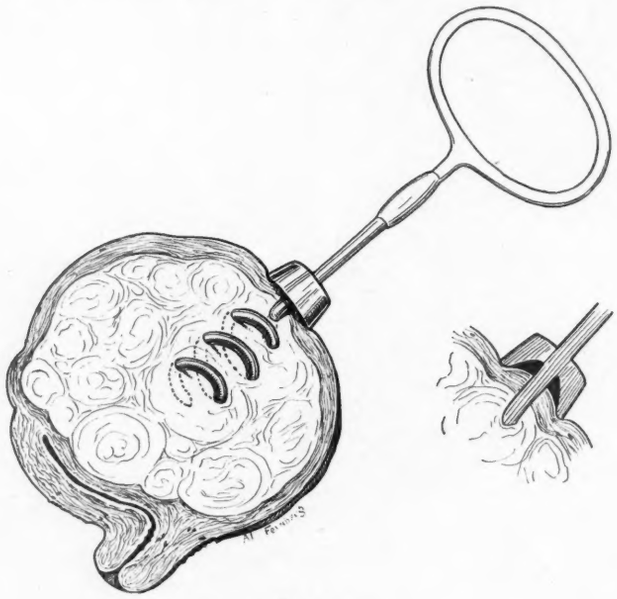


Fig. 1.

This modification has been used with great satisfaction by me and some of my confreres for the past three years.

Bookshelf Browsing

THE CARNERO

A FISH PARASITE OF MAN AND POSSIBLY OF OTHER MAMMALS

KENNETH W. VINTON AND W. HUGH STICKLER*
From the Division of Schools, The Panama Canal, Canal Zone.
CRISTOBAL, CANAL ZONE

DURING the months of June, July and August, 1938, the writers were members of a collecting party on the headwaters of the Amazon River in the *montaña* region of Eastern Peru. It was at Yurimaguas on the Huallaga River some 400 miles above Iquitos that we gained firsthand information concerning the interesting fish parasites known by the collective name *carnero* (*candirú* in Brazil) which are alleged to have the vicious habit of entering the urethra of men and women bathers, particularly if they micturate while in the water. While traveling in Peru two years previously, the senior author had heard of these fish from an adventurer. Charley Lamott was a radio announcer, an ex-purser and a general traveler. He was familiar with the *montaña* from Chile to Peru. Fifteen years before he had guided a gold-mining party over the Andes and down the Amazon. While returning from South America in 1936 we had shared the same stateroom, and the strange story of a fish which enters the body orifices was one of the many that he told. On that occasion the writer had listened to the story, smiled knowingly and discounted it as a myth. However, while dicussing the Amazonian fishes with Indians, one of them mentioned a slender fish that attacks people. They became quite excited when telling about the creature but did not make themselves clear as to how the attacks occurred. Residing in Yurimaguas was Rev. Edgar J. Burns, a missionary with some medical knowledge and experience. When asked about the fish he said, "Oh yes! You mean the *carnero*. It is true that they attack people by entering the body orifices and feeding inside the body. They have spines on the head, and once one starts into an opening the spines prevent it from being withdrawn." The missionary had a wealth of information, and for the next few days the mission fairly buzzed with talk about the carnero. Yet reports of the existence of such creatures seemed incredible.

Tales of these unusual fish have filtered out of the Amazon region for more than 100 years. At first the stories were discredited as fantastic. However, there is no doubt that the creatures actually exist. Dr. H. H. Rusby, the well known pharmacognosist, has traveled extensively through tropical America and is well acquainted with the medical plants of that region. In a letter to us he says, "As to the attacks of the *carnero* on men and women the records are established. Feather-bed explorers and theoretical researchers have disputed the facts, but the evidence is abundant and confirmed."

Dr. Eugene W. Gudger, of the American Museum of Natural History, has made the most extensive study on this subject to date. From the literature he has brought together accounts extending from Martius

* The authors acknowledge with gratitude the assistance of Dr. Eugene W. Gudger of the American Museum of Natural History in the preparation of this article.

in 1829 to G. H. H. Tate in 1926. He also quotes letters from various practicing physicians in the Amazon region who recite their own experiences. In his volume *The Candirú*[1] he has reached the same conclusion as Dr. Rusby.

For the three years previous to our visit Mr. Burns had given medical aid to the Indians in connection with his missionary work in Yurimaguas. Altogether he had worked in the Amazon country for seven years. During that time he had known ten persons who had been attacked by the carnero. In five instances he had had personal dealings with the victims at the time of the accidents, while in the other five cases he had treated the people for hemorrhage after the fish had been dislodged. At one time he had treated three persons within a week.

It will be interesting to note the distribution of sexes and ages in these attacks. Four of the victims were mature women, three were girls ranging from ten to sixteen years of age, one was a mature man and two were boys aged twelve and thirteen. Mr. Burns also added, "Many other cases have been reported, but I have had no definite dealings with the individuals. However, I have conversed with many of these victims at various times afterwards. In most cases the persons attacked were women, men comprising relatively few cases. After several years in this region I am prepared to state that women are the more commonly attacked." This situation is to be expected when one considers the comparative anatomy of the genitourinary organs in the two sexes. Inasmuch as the orifice is much larger in women, penetration is considerably easier. In all cases which came to Mr. Burns' attention the urinary tract had been attacked. Rumors of entrance into the mouth, ears, nostrils and anus were reported, but the missionary was unable to verify them.

In the cases reported by Mr. Burns the pain was generally mild. Males seemed to suffer somewhat more than females. However, the fear element was great in all cases. From our own conversations with the Indians we concluded that they fear the *carnero* or *candirú* more than the vicious *paña* or *piranha*, which also infest these waters.

Questioned concerning the amount of bleeding, the missionary reported it as being most variable. He said:

"In one instance a sixteen-year old girl came out of the water and did not know that she had been attacked until she saw the blood flowing down her legs. Naturally, at the moment it was mixed with the water running off her body, but even afterwards I had to give her a suitable intravenous injection to stop the flow. In this case the bleeding was most profuse. Also in the case of the man and one boy the blood flow was very great, so much so that the victims were becoming prostrate. Again I had to administer suitable injections to stop the hemorrhage."

Asked whether he had ever known of a person bleeding to death by an attack of this fish, Mr. Burns replied, "No, I have not. The natives speak vaguely of such deaths, but here again there is no real proof. However, I certainly believe death could result, judging by the amount of blood some have lost through the attacks."

The fish in question are small catfish belonging to the family Pygidiidae. These are long, slender fish with weak fins, rasping or file-like teeth and patches of spines on the head and opercula. (Fig. 1.) Members of the group, as shown by Gudger, are known to be secretive, carnivorous and in many instances ectoparasitic on Siluroid fish. The transition to endoparasitism, therefore, is not incredible since we find them living in the gills of many of these large Siluroids, rasping the delicate tissues and feeding on the blood. On this matter Norman says the carneros " . . . habitually live within the gill-cavities of large catfishes and other fresh-water fishes, their slender form enabling them to penetrate between the gills, the sharp teeth and opercular spines being used to start the flow of blood from the host, which is sucked

up by the mouth. The patches of spines on the gill covers also serve to assist the fish to wriggle between the gill-lamellae, and to

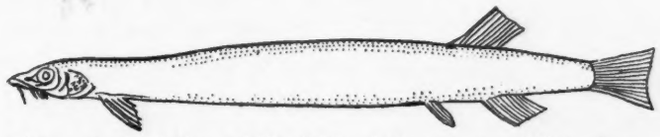


Fig. 1. Lateral view of *Vandellia cirrhosa*, natural size, showing general characters of pygidiid catfishes. (From Gudger after Cuvier and Valenciennes, 1846.)

retain the hold when once established."[2] These features are shown in Figures 1 and 2.

In these cases of internal parasitism there has long been the question as to whether the creatures are urinophilous. We queried Mr. Burns about this. He replied, "I asked one boy about that after he recovered. He said he was urinating in the water when he first felt something and at once rushed out of the river without bathing. However, he had already been attacked. In every case where the people have spoken with any certainty at all the situation seems to be the same as with the boy." Then, in this connection, he related this interesting incident: "A neighbor of mine rushed a cow to his balsa or raft to embark it. The animal did not wish to go on to the craft. As it was urinating, it slipped into the river and came up bleeding profusely—decidedly from the urinary vent. I understand the cow died the same day from loss of blood." His reply to our letter on this point does not state how long the animal was in the water nor how long the attack lasted. Another case of a cow being attacked will be considered later. These instances do not prove that the fish are urinophilous, but apparently urine is a factor to be considered in the attack.

Dr. Gudger[3] suggests three possible interpretations: that these fish are tropic to urine, that they are merely reacting to the current of water and would have so responded if water from the same stream had been poured out of a bucket or tea-kettle, and third that they are attracted by the noise. We are inclined to question the last alternative since attacks occur as frequently when one is micturating while in bathing as when one urinates into the water. Concerning this Norman writes, "The little fish appears to penetrate into the urethra especially, if not always, during micturition, and it has been suggested that

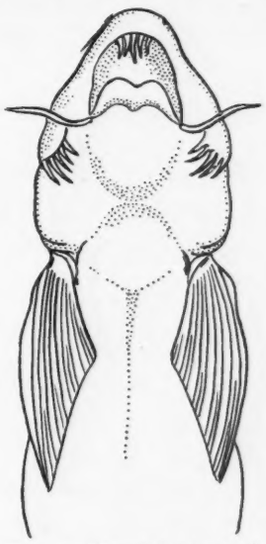


Fig. 2. Ventral view of the head of *Vandellia cirrhosa*, showing ventrally placed mouth with five teeth in upper jaw and inward and backward pointing spines on lower part of each operculum. (From Gudger after Cuvier and Valenciennes.)

it is definitely attracted by urine. It seems more probable, however, that the flow of urine is merely mistaken by the fish for the respiratory current coming from the gill-opening of a fish."[4] These observations are merely recorded here. Whether the parasites are tropic to urine can be settled only by experimentation. However, the present evidence tends to indicate such a tropism.

Numerous reports have been made as to the precautions taken to prevent accident when bathing. In some sections of the

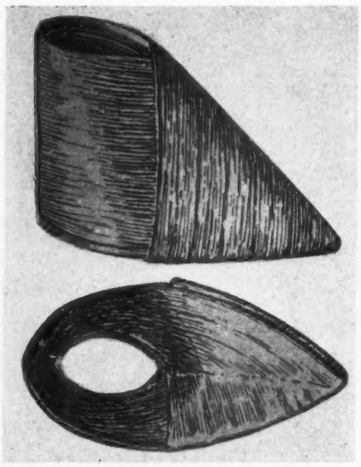


Fig. 3. Lateral and underside views of genital guard worn by men of Kanapé and Tapirapé tribes along Araguana River. (From Gudger after Krause, 1911.)

Amazon the men tie the prepuce with a string. In other regions sheaths woven from palm leaf fibers are worn by both men and women. Such sheaths are known to be used by the natives living on the headwaters of the Tocantins and Xingu Rivers of the Amazon system. Gudger figures and describes three of these, and of these three we reproduce one in lateral and underside views. (Fig. 3.) At Yurimaguas apparently no such devices were used. Most of the people do not even enter the water when they bathe. They are afraid of the carnero and prefer to pour water over themselves from calabash containers. Only the younger children enter the water without anything on. The adults almost always use some sort of pants. Possibly the fact that these people have a dependable cure may be a factor in this lack of special protection.

Once the fish has attacked, the treatment seems to vary in different regions of the Amazon. Many explorers report immediate surgery as the only type of relief. In 1897, Dr. G. A. Boulenger, Curator of Fishes at the British Museum of Natural History, quoted Dr. J. Bach, a physician in active service on the Jurua River, as contending that the only means of preventing the fish from reaching the bladder, where it causes inflammation and ultimately death, is to operate immediately. He also records the examination of four natives, a man and three boys, in which the penis had been amputated as a result of this dreadful accident. We were unable to find such serious consequences at Yurimaguas.

Here the locally recognized and only treatment used is that of the *huito* or *Jagua* fruit. We collected this fruit. It has been identified by Mr. Charles Gilly and his identification confirmed by Mr. B. A. Krukoff and Dr. Albert C. Smith, all of the New York Botanical Garden, as *Genipa americana* L., the fruit of a common tree in the tropics of Central and South America. (Fig. 4.) The only references to this treatment which we are able to find are in the writings of Poeppig (1836) and Marcoy (1869) as quoted by Gudger. Even here it is to be noted that Poeppig uses the spelling *Xagua*. However, there seems to be no doubt that it is the same fruit in all cases. We quote first from Poeppig: "In Yurimaguas I myself have been an eyewitness of such an attack. An Indian woman, after an attack by a *Carnero* into the vagina, suffered such frightful pain and loss of blood that she was given up to die. However, after both internal and external applications of *Xagua*, the little fish was gotten out and the woman came through alive."[5] And Gudger quotes Marcoy as follows: "To the horrible sufferings which the introduction of this living needle may occasion, the Ucayali doctors know of but one remedy which consists of a *tisane* made with the *genipa* or *huitach* apple, and which, taken very hot, acts, they pretend, on the urinary passages, and dissolves the animal which obstructs them."[6]

Both Dr. H. H. Rusby, referred to previously, and Dr. Paul C. Standley, Curator of Botany at the Field Museum of Natural History, are familiar with this tree, but neither had ever heard of the juice of the unripe fruit being used in treating attacks

by the carnero. Dr. Rusby writes to us that: "The juice, when unripe, makes a fairly good indelible ink, and I have often thought that it might be so treated as to make it commercially valuable for that purpose, or for dyeing. I have never heard of its use in the treatment of *candiru* lesions and do not see how, in the nature of the case, it could be of service. This fish forces its way into the urethra as far as possible and cannot be removed without severe surgical operation because of the spreading of its fins. The damage is thus mechanical, and there is nothing specific that can be done in treatment. This astringent juice would doubtless tend to check the hemorrhage."

All that Dr. Standley has to say concerning this fruit is that: "Upon cloth and other articles the juice produces a brownish or blackish permanent stain, hence it is much used by the primitive inhabitants of the region for dyeing, and especially for painting the body."[7] We found that if the green center is rubbed on the skin it turns black very soon afterward and remains so until it wears off. Certain of the natives along the Huallaga seemed to think that it aids in repelling insects and curing insect bites. At least when insect pests became too abundant the natives often painted their legs, arms and even their faces with this juice. Opinion as to its effectiveness seemed to be divided.

As stated above, the unripe jagua fruit (Fig. 5.) is the standard treatment for dislodging the carnero once it has attacked. The centers of the smaller green fruits are scraped out, mashed and squeezed and mixed with water, the strength of the preparation varying considerably. The potion has a bitter taste and the puckering effect of a fairly strong astringent. The preparation is taken by mouth. In a comparatively short time, varying from a few minutes to about two hours, according to the natives, the fish is dislodged. Mr. Burns states that, although this cure sometimes causes the patients to become quite nauseated, he has never known the treatment to fail, nor can he learn of a failure from the natives. Neither has he ever known the fish to be dislodged without this form of treatment.

Fig. 4.

Fig. 5.

Fig. 4. The *jagua* tree, *Genipa americana* L., which is found throughout tropical Central and South America. The birds on the branches are vultures. (Photograph by Ralph Davis.)

Fig. 5. Unripe *jagua* or *huito* fruit, *Genipa americana* L., the juice of which is used to dislodge the carnero once it has attacked. (Photograph by W. Hugh Stickler.)

It appears that in the region of Yurimaguas, as well as in a number of other settlements along the lower Huallaga River, the juice of the green *jagua* fruit has for generations been administered in the case of attacks by the carnero. At least in

1938 everybody knew about the treatment and conversed freely concerning it as they did in Poeppig's day—1836. The fish is reported to have been successfully driven out of the host's body so frequently that it is difficult to believe that the desired results have occurred as timely accidents in such a large number of cases. But in the absence of scientific proof the best we can do is to speculate in the matter.

Even after leaving Yurimaguas on the Huallaga River, and while traveling along the Ucayali for eight or nine hundred miles, frequent inquiries disclosed the fact that the natives along the whole length of the lower river were familiar with the carnero and feared its attacks. When asked what to do in case a carnero should attack us, the jagua juice was invariably mentioned as the cure. On one occasion while traveling through the native town of Pucalpa, some eight hundred miles up the Ucayali, the senior author stopped an Indian under a *jagua* tree and asked, "Does this tree have any medicinal value?" "Si, si, senor," he answered, "It is used in driving the *carnero* out of your body when it is eating you."

Again picking up our story in Yurimaguas, two cases will serve to show the nature of these attacks and the treatment employed. In the case of the ten-year old Indian girl, the fish had been lodged in her genitourinary passage for six hours before it was finally driven out by the native treatment. The Peruvian doctor, who had only recently arrived in this section from the dry west coast of Peru and who was not familiar with this phenomenon, said the fish would have to be removed by surgery. The girl's parents refused consent and brought the case to Mr. Burns. He sent for several of the older and most reliable Indians and asked them about the native cure. They all agreed that the green fruit of the *huito* or *jagua* tree would drive the fish from her body. He told them to administer their customary treatment. They said the fish came out, but the missionary never saw it, their excuse being that the chickens had eaten it when it was put aside. Some three hours later the parents called again, and Mr. Burns gave the girl a suitable hypodermic injection to stop the hemorrhage. The injured organs in the girl's body became infected, and she was quite ill for several weeks. Under Mr. Burns' care she finally recovered and seemed none the worse for the experience.

Another gruesome case was that of a thirteen-year old boy. The fish had entered his penis, and by the time the young Indian had reached the mission a half hour after the attack his trousers were saturated with blood, and it was running over his bare feet. He seemed to be in considerable pain. Mr. Burns, fearing that he might not succeed as the Indians do with their huito juice, said that he had no medicine for such cases. He suggested that they treat the boy according to their own customs and lost no time in sending the Indians for the fruit. This time they had to cross the river, over one-fourth of a mile wide at this point, to get green fruit. There was plenty of ripe fruit at hand, but this is not suitable for the treatment. The men brought the green fruit, prepared it, and gave the boy a good drink, about a pint, of the unpalatable medicine. This, of course, could be prepared in varying strengths. The next day, hearing that the boy was very weak from loss of blood, Mr. Burns went to his house and was told that the fish was dislodged about two hours after the potion was administered. The boy was still suffering with a slight hemorrhage, and micturition was painful. However, he recovered completely.

Not only human beings but also domestic animals as well are attacked by these fish. The case of a cow reported as being attacked and killed has been noted. Mr. Burns stated that in order to prevent their bleeding to death many cows had been slaughtered. Such attacks are made easy by the custom of bringing the cattle downstream to the local market at Yurimaguas by making them swim alongside a dugout. The animals may be in the water for lengthy periods. Considering the number

of animals brought to market in this manner, the number of attacks is relatively few. One instance is worthy of consideration since it shows the extensive loss of blood during a severe attack. It happened that the cow was white, and hence the spectators noticed her bloody coat as soon as she climbed the river bank after her two-hour swim downstream. The owner, seeing that the animal was very weak, called for assistance. Mr. Burns reports that she was half-carried, half-dragged by the men to the nearby slaughter house. When her throat was slashed the surprised bystanders found that very little blood flowed from her veins. The creature bore no sign of external injury nor sign of ill treatment by man, stick, or piranha. The men who dressed the carcass all declared it was the result of an attack by a carnero. Mr. Burns completely discredits the possibility of an attack by piranha in this instance.

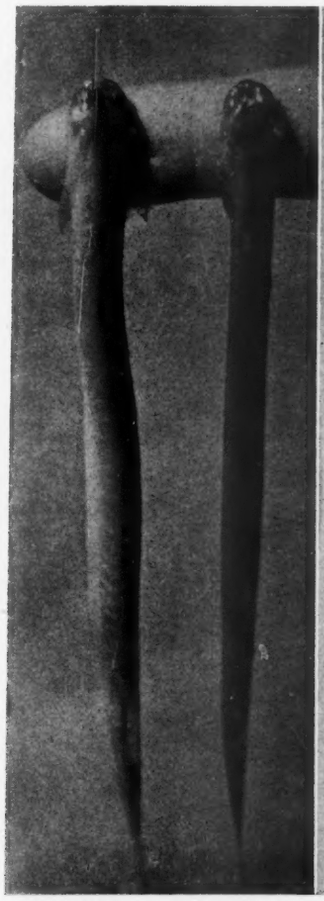


Fig. 6. Two specimens of *carneros* hanging on the finger by means of the spines on their opercula. (Photograph by Ralph Davis.)

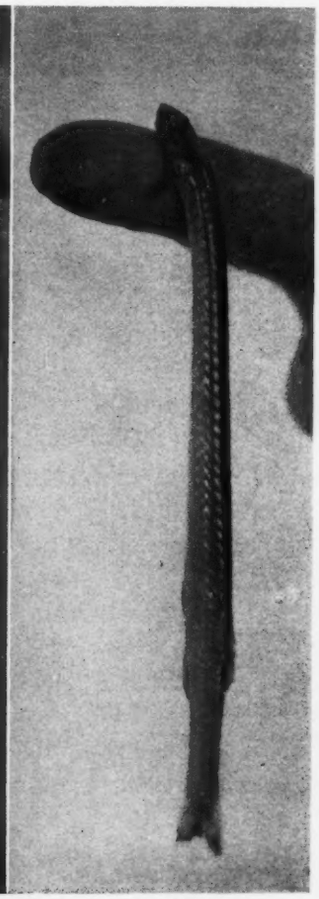


Fig. 7. A close-up of *Vandellia plaizae*. (Photograph by Ralph Davis.)

After the cow was slaughtered the missionary examined the parts affected. He reports that: "Slight lacerations were to be found some three inches more or less up the urinary tract. Seemingly only this region was attacked since the vaginal and uterine tissues showed no injury. The lacerations were not extensive but appeared somewhat raised and whitish." The fish, however, had escaped. The carcass was eaten by the natives.

This brings us to another interesting point. Several times Mr. and Mrs. Burns had tried to eat the flesh of cows that had been slaughtered after an attack by the

carnero, not, however, in the case just mentioned. In each instance they reported that the flesh was "most distasteful." Mr. Burns added, "Very little trying was sufficient, and the meat was thrown out. It had a strong taste. In each instance the animal had been brought to town swimming alongside a dugout when the attack was made. Whether different grazing conditions upstream could make the difference in taste we are not sure." When asked whether their psychological reactions might not have entered into the consideration, Mr. Burns steadfastly maintained that: "Under no circumstances could it have been our psychological reactions because we did not know what had happened until we inquired afterwards." We offer no explanation here, but we do believe this account is worthy to be recorded.

Upon learning that the carneros could be caught by using a large piece of bloody meat, we spent two long afternoons fishing for them. The first time we used a cow's lung, which we repeatedly sopped in blood, and captured two nice specimens. On the second occasion turkey viscera sopped in turkey blood was offered but with no success. The turkey viscera sank so deep in the water that it was eventually consumed by the small piranha. The lung was floated in such shallow water that the piranha did not bother it so much.

When the slithery carneros found the bloody meat, the dip net was not necessary to capture them for they writhed about and literally wormed their way into the flesh. When the lung was lifted from the water they clung to it with their spines and were removed only with some difficulty. In the same way they clung to the finger of their captor as shown in Figure 6. These specimens have since been identified at the American Museum of Natural History by Mr. John S. Robas as *Vandellia plaizae*, one of the specimens known to attack man. Of course, there are a considerable number of other species in the family Pygidiidae which also are known to have this unusual habit of endoparasitism.

Our specimens were between five and six inches long and were of a diameter rather less than that of a lead pencil. We were led to believe that most of the offenders are considerably smaller than this. Our fishes were light in color, had smooth skins, and each had a pair of short "feelers." Hand lens magnification showed four rounded clusters of curved needle-like spines on the fish's head. A pair of spine clusters were on the margin of the gill covers were up on each side of the head, and two were on the opercula underneath. The mouth was somewhat sucker-like with a number of rasping spines or teeth in the upper jaw.

Figure 7 is made from a photograph in oblique-dorsal view and hence does not show the details referred to in the preceding paragraph. These details may be seen in the drawings reproduced in Figures 1 and 2. Figure 7 does, however, give an idea of the general form of the body, tail and fins. As far as we know, these are the only photographs of the carnero ever published.

The little fish are extremely bloodthirsty. Even after the lung was lifted from the water, the vicious little creatures continued to crawl about the bloody surface biting and chewing as they went. One of the specimens found an opening in the lung and almost disappeared by rapidly wriggling its way inside. When an attempt was made to pick up the live specimens, their instant reaction was to turn and bite the offending fingers. The bite of these fish was like the rasping of a coarse file (Fig. 2) and, like a file, would draw blood if applied too often in the same spot. Without a doubt this fish can cut through tender mucous tissue in a short time, if not with the first rasp.

Since we had two live specimens, this seemed an excellent opportunity to test the effect of the jagua juice on them. Although the water in the large container in which the fish were kept was changed several times during the night, one of the fish was nearly dead and the other quite sluggish the following morning. The jagua was collected and the juice prepared as quickly as possible. Then the livelier specimen was placed

in the dilute mixture. The little fish became suddenly active and, after swimming around rapidly and showing other signs of discomfort for about two minutes, turned over on its back and remained motionless. The fish was not dead, however, for upon being placed in fresh water it revived. It was unfortunate that we did not have more live specimens with which to experiment for the vitality of this one was at low ebb, and the reaction may not have been normal.

At the present time there seem to be two interpretations of the manner in which the fish injures its host. Some well known scientists, including Dr. H. H. Rusby, think that the injuries are of a mechanical nature only and are caused by the fish as it uses its needle-like spines to work its way in the tender tissues. Others hold that the carnero feeds upon blood and uses this method of finding tender membranes that it can rupture easily with its rasping teeth. We are inclined to subscribe to the latter viewpoint. It is definitely known that the Pygidiidae are secretive and ectoparasitic and that some of them are endoparasitic. It seems reasonable to suppose that a fish that has taken the trouble to work its way inside of a host's body has done so because of some strong instinctive urge. Since there is such profuse bleeding in many cases it is logical to believe that the fish has sought this location for the purpose of feeding on blood and possibly the tender tissues. In fact, the bleeding is so out of proportion to the size of the lacerated area that we are tempted to speculate on the possibility that the fish passes the blood through its own body at a rapid rate in addition to the hemorrhage from the mechanically injured tissues. That, however, would be purely conjecture. Nevertheless, carneros greatly distended with blood have been reported. For instance, Gudger[8] quotes Eigenmann as capturing *Vandellia sanguinea* " . . . gorged with blood." The bloodthirsty dispositions of the live carneros and the frenzied manner in which they attacked the bloody lung when they were being captured also indicate that the fish in question had avid appetites for blood.

Assuming that the fish feeds on blood, it appears possible that the jagua juice may contain some chemical substance that will affect the blood sufficiently, possibly by making it distasteful, to cause the fish discomfort and to stop the feeding process. One might reasonably expect that once the feeding had stopped the fish would attempt to dislodge itself. Here we seem justified in venturing the conjecture that the head and opercular spines are under muscular control and can be withdrawn when the fish so wills. The case of the white cow seemed to indicate that the fish had returned to the water when they had practically exhausted the animal's blood supply. However, among human victims we heard of no case wherein the fish became dislodged without the *jagua* juice treatment.

Many questions arise in connection with these strange creatures. How does the fish obtain oxygen while in the host's body? How long can it live as an internal parasite? Will it eventually leave the host of its own accord? Is the creature attracted by the odor of urine? Is it really a blood-feeder or are the injuries purely mechanical? If it is a blood-sucker, what does it feed upon when it cannot find blood? How does the *jagua* juice bring about the dislodgement of the animal? Since these fish attack man and cattle, may they not also attack the warm-blooded manatees and porpoises which inhabit the waters of the Amazon? These and other problems offer unusual disclosures to the scientist who can unravel them.

REFERENCES

1. Gudger, Eugene W. The Candirú. New York, 1930, Paul B. Hoeber, Inc.
2. Norman, J. R. A History of Fishes. P. 250. New York, 1931. Frederick A. Stokes Company.
3. Gudger, Eugene. Op. cit: p. 73.
4. Norman, J. R. Op. cit: p. 250.
5. Gudger, Eugene. Op. cit: p. 6.
6. Ibid. P. 11.
7. Standley, Paul C. Flora of the Panama Canal Zone. Contributions from the U. S. National Herbarium. Vol. 27, p. 357, 1928.
8. Gudger, Eugene. Op. cit: p. 37.

Selected Book Review

ABDOMINAL SURGERY OF INFANCY AND CHILDHOOD*

By William E. Ladd, M.D. and Robert E. Gross, M.D.

WHEN the editors of The American Journal of Surgery decided to devote an entire issue to the Surgical Diseases of Children, they surveyed the field in quest of a Guest Editor who was pre-eminent in this field. Finally, they decided on William E. Ladd. He accepted the assignment and the popularity and extraordinary worth of that number is now history. Therefore, we were not surprised to learn that he and Dr. Gross had written a complete work entitled "Abdominal Surgery of Infancy and Childhood" which has been published by the Saunders Company. Upon the receipt of this book for review we immediately sought from those in the profession, who had the book and whose opinions were reliable, an expression of their views regarding this work. In every instance the response was the same: "Good." Some called it "marvelous," "very much need" or "top-notch." After carefully going through its pages we, too, can use any of the adjectives denoting its superiority and excellence.

Twenty-five years ago the late Dr. James S. Stone first fostered the idea of devoting the major part of the time of the surgical staff of Boston Children's Hospital to pediatric surgery. As the authors state, "This does not imply that pediatric surgery should always be set apart as a separate specialty, but it does indicate that infants and children can obtain improved surgical care if an appropriate number of men in each community will take a particular interest in this field and give it the attention which it rightfully deserves."

This book, which is devoted to that part of children's surgery which involves the abdomen, was written with the intention of developing better methods of examination, more detailed preopera-

* Philadelphia, 1941. W. B. Saunders Company.

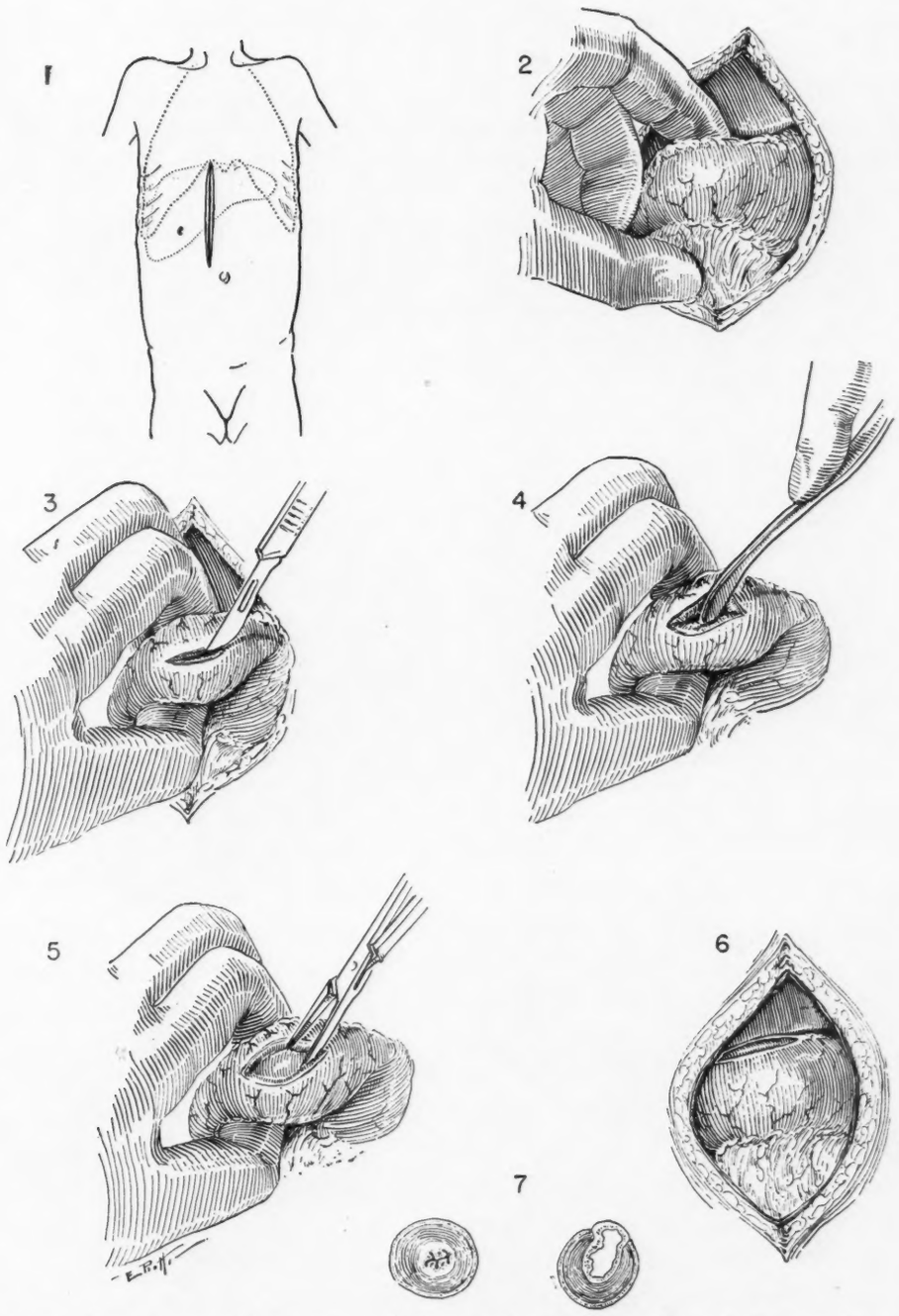


Fig. 1. Steps in operative treatment of congenital hypertrophic pyloric stenosis. 1, position of the skin incision. Right rectus, muscle-splitting incision. 2, delivery of the pylorus up into the operative wound, 3, pylorus held between two fingers, and rotated downward so that incision can be made along its superior surface where the vascularity is minimal. Incision carried through only the serosa and superficial muscle fibers. 4, division of the deeper muscle fibers with a blunt instrument. A rounded handle of the scalpel serves best for this step. 5, separating the edges of the muscular coat with a hemostat, so that the mucosa is exposed and is allowed to bulge up into the muscular defect. 6, pylorus dropped back into the abdomen, showing the pyloromyotomy on its superior surface. 7, cross section of hypertrophied pylorus before operation (*left*) and after operation (*right*). Following operation the mucosa pouts up through the muscular slit to the level of the preexisting serosa. (Fig. 6, on page 12, in Ladd and Gross' "Abdominal Surgery of Infancy and Childhood." W. B. Saunders Company.)

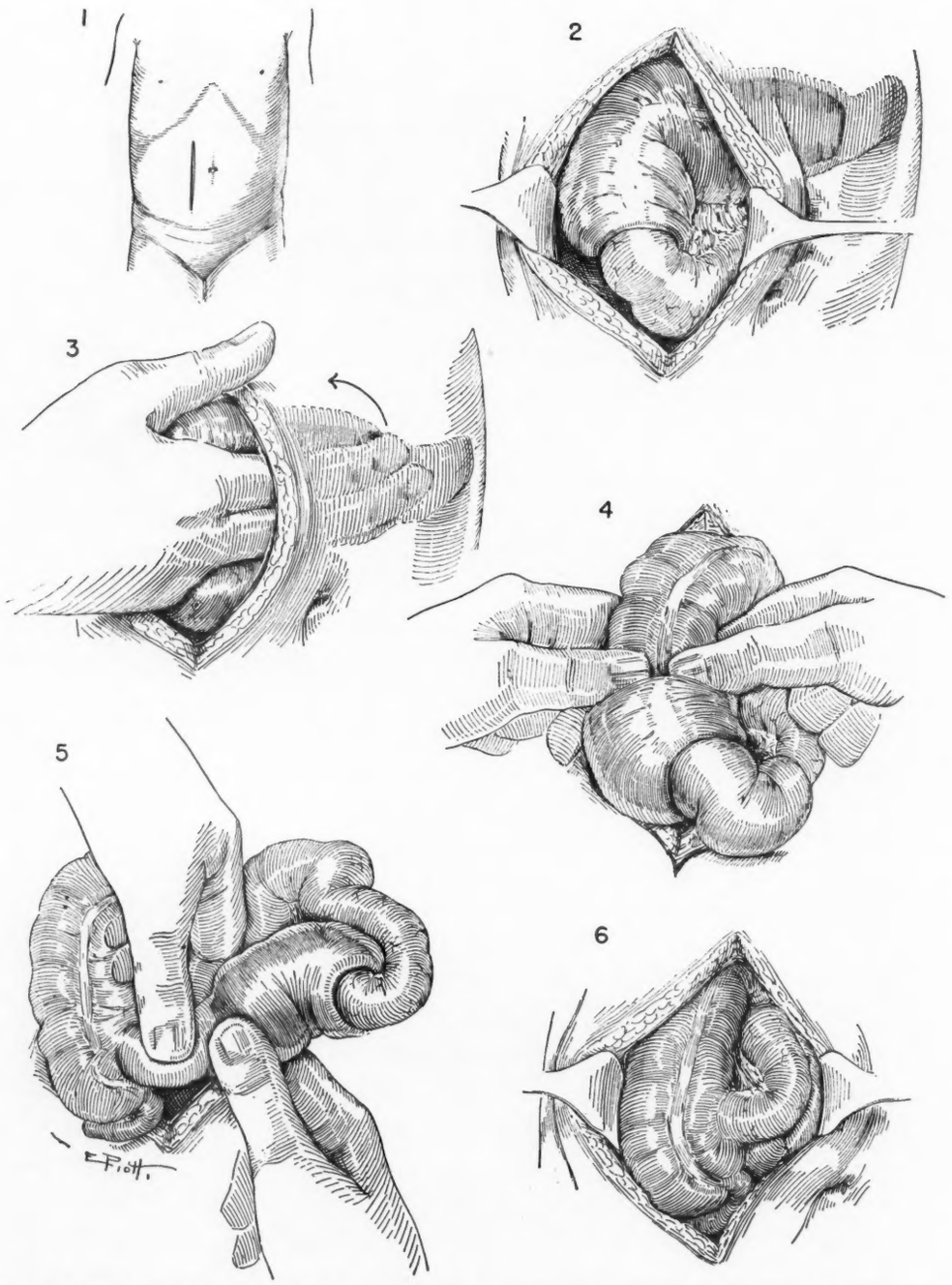


Fig. 2. Method of operative reduction of ileo-colic intussusception. 1, incision is always made on right side of abdomen, regardless of position of palpable mass. 2, findings on opening abdomen. Ileum is intussuscepted into ascending colon. Intussusception extends almost to the splenic flexure. 3, portion of hand passed in to left side of abdomen so that the finger tips can push back intussusceptum in direction of arrow. 4, intussusception has been reduced to the ascending colon which is now delivered out of the abdomen. Squeezing over the distal end of the mass is now begun. 5, cecum and appendix have been delivered. Remaining intussusception in ileum is reduced by continued squeezing on the receding mass. 6, reduction completed and intestines returned to abdomen. (Fig. 77, on page 116, in Ladd and Gross' "Abdominal Surgery of Infancy and Childhood." W. B. Saunders Company.)

tive and postoperative care and a more specialized and delicate operative technic. The authors have lived up to this blueprint to the letter. For many years the authors and their co-workers intended

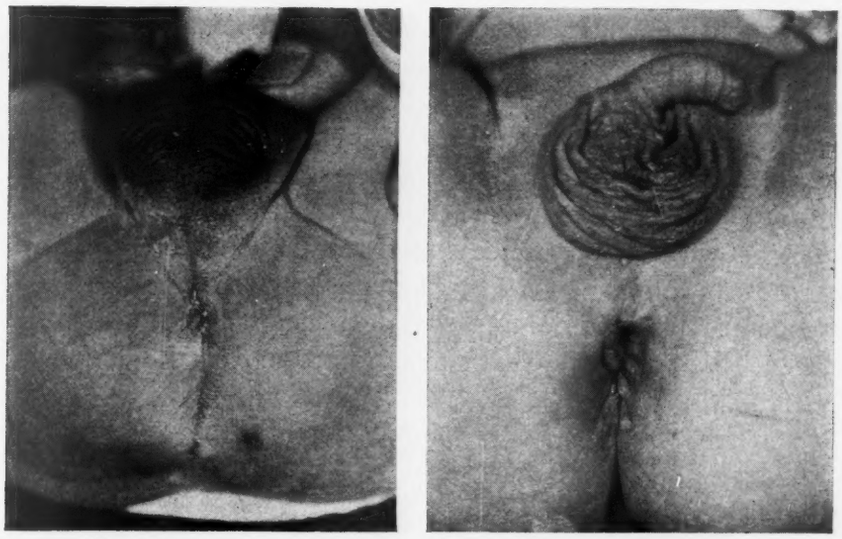


Fig. 3. Male infant with imperforate anus (Type 3). *Left*, appearance of perineum at one day of age, prior to operation. *Right*, appearance of anus two months after proctoplasty (sphincter muscle has good tone). (Fig. 112, on page 174, in Ladd and Gross' "Abdominal Surgery of Infancy and Childhood." W. B. Saunders Company.)

to gather the subject matter which would result in this book but inadequate financial backing postponed the effort until a generous grant was received from the Godfrey M. Hyams Trust Fund which made it possible to bring the work to completion.

The contents include chapters on congenital hypertrophic pyloric stenosis, peptic ulcer, gastrostomy, congenital atresia of the intestine and colon, congenital stenosis of the intestine and colon, intestinal obstruction resulting from malrotation of intestine and colon, Meckel's diverticulum, duplications of the alimentary tract, foreign bodies in the gastrointestinal tract, intussusception, polyps of intestine and colon, congenital megacolon, chronic idiopathic ulcerative colitis, malformations of the anus and rectum, primary peritonitis, appendicitis, hiac adenitis, omental cysts and mesenteric cysts, diseases of the spleen, congenital atresia of the bile ducts, obstructive jaundice from inspissated bile or mucus in the biliary passages, idiopathic dilatation of the common bile duct, cholecystitis, cholelithiasis, hepatic tumors, anomalies of the

gallbladder, injury to the extrahepatic bile ducts, rare conditions of the umbilicus and abdominal wall, omphalitis, omphalocele, umbilical hernia, congenital hernia of the diaphragm, intra-abdominal hernia, inguinal hernia, hydrocele, undescended testis, tortion of testis and appendix testis, diseases of the female genital tract, exstrophy of the bladder, embryoma of the kidney and neuroblastoma sympathicum.

A Bibliography (only when necessary to supplement the authors' material) is at the end of each chapter. The illustrations (about 270 in number) are very well done and there is an elaborate Index.

It goes without further saying that this book should be owned and read carefully by every surgeon who is called upon to diagnose and operate upon abdominal surgical conditions in infants and children. It is one of the year's most important contributions to the surgical field.

SPECIAL MONOGRAPH

CESAREAN SECTION

The Modern Operation

BY

CHARLES A. GORDON, M.D.

Professor of Clinical Obstetrics and Gynecology, Long Island College of Medicine

AND

ALEXANDER H. ROSENTHAL, M.D.

Instructor in Obstetrics and Gynecology, Long Island College of Medicine

AMERICAN JOURNAL OF SURGERY, Inc.

NEW YORK · MCMXLI

TABLE OF CONTENTS

	Page
1. Introduction	528
2. The Cesarean Factor in Puerperal Mortality	529
3. Indications	530
a. Contracted Pelvis	530
b. Antepartum Hemorrhage	533
Placenta Previa	533
Ablatio Placentae	534
c. Pelvic Tumor	535
d. Abnormal Presentation	536
e. Postoperative Dystocia	537
f. Fetal Indication	538
g. Previous Cesarean Section	539
h. Medical Complications	542
Cardiac Disease	542
Tuberculosis	543
Diabetes	543
i. Other Indications	545
4. Contraindications	545
5. Preparation for Operation	547
6. Blood Transfusion	549
7. Anesthesia	550
8. Incidental Surgery	555
9. Types of Cesarean Section	556
Classical	558
Lower Segment	560
Peritoneal Exclusion	568
Extraperitoneal	570
Hysterectomy	573
Exteriorization	575
10. Postoperative Care	576
11. Complications and Sequelae	577
12. Prognosis	579
13. Conclusion	581
14. References	583

CESAREAN SECTION

THE MODERN OPERATION

CHARLES A. GORDON, M.D.
Professor of Clinical Obstetrics and Gynecology, Long Island College of Medicine
AND
ALEXANDER H. ROSENTHAL, M.D.
Instructor in Obstetrics and Gynecology, Long Island College of Medicine
BROOKLYN, NEW YORK

INTRODUCTION

CESAREAN section is a comprehensive term for all the operations which have been devised to effect the delivery of the child through an incision in the abdominal wall and the uterus. Laparotomy for abdominal pregnancy and rupture of the uterus during pregnancy and labor is not included. Vaginal cesarean section is misnamed.

The operation itself is of great antiquity. Its history has been so often written that it will not be repeated in detail here. For centuries results were so bad that it was merely an operation of last resort, performed after failure of infravaginal delivery. In the United States, hardly more than fifty years ago, cesarean section was a formidable operation with about 60 per cent mortality. Because of its hazards it was held "chiefly justifiable in cases in which craniotomy and the delivery of the child through the natural passages involve the life of the mother in still greater peril, and indicated therefore in extreme pelvic contraction, in the case of solid tumors which encroach upon the pelvic space, and in advanced carcinomatous degeneration of the cervix."[61] Many operators did not suture the uterine incision at all but were content with uterine contraction initiated by friction and the use of ice. Women died of sepsis and hemorrhage then as they do now. Kehrer,[51] not Sanger, really deserves credit for priority in the modern operation, for in 1881 he performed a new type of cesarean section through a transverse incision in the lower uterine segment at the level of the internal os, and closed the uterine muscle and overlying peritoneum separately.

THE CESAREAN FACTOR IN PUERPERAL MORTALITY

Improved technic has so widened the indications of even a few years ago, that many have come to believe that cesarean section is safe enough for all obstetric difficulties, even minor ones. Yet cesarean section occupies a very prominent place in puerperal mortality. Statistics in support of this statement are available from almost every section of the United States, yet excellent results in large numbers of cases are reported by skillful operators who exercise good judgment in the selection of patients and the proper type of operation.

The Obstetric Advisory Committee of the Children's Bureau[95] commenting on maternal mortality in fifteen states defined cesarean section as an abdominal operation to remove a viable fetus through a uterine incision and found it "evident . . . that poor selection of cases and unwise selection of the type of operation were frequent. The number of classical cesareans done for abnormal presentation after delivery from below was attempted was astounding. Forty-five per cent of all the women who had cesarean section had had more than one pregnancy. Local anesthesia was used in surprisingly few cases. The tremendous mortality attending cesarean section throughout the United States warrants a careful review of the indications for the choice of operation."

In New York City from 1930 to 1932, 19.8 per cent of all maternal deaths were preceded by cesarean section.[71] In 1939, in 108,018 terminated pregnancies, 2,558 cesarean sections were performed with a mortality of sixty-eight or 2.7 per cent, yet 21.3 per cent of all puerperal deaths followed cesarean section; twenty-seven of these deaths occurred in the Borough of Brooklyn, contributing 24.5 per cent to its total puerperal mortality.[32] Hemorrhage and shock were common immediate causes of death.

DeNormandie,[19] reviewing the number of cesarean sections in Massachusetts in 1937, found an incidence of 1 in 30.3 births. Irving[46] found that 24 per cent of all puerperal deaths in California in 1928 followed abdominal delivery, while in Boston, from 1933 to 1935, 27 per cent of all puerperal deaths were preceded by cesarean section.

Lynch[62] states that "more than one-half of the deaths following section have occurred in women who previously had borne children through the normal birth passages. And furthermore 0.76 per cent

of all women delivered in the United States in 1934 were by cesarean section."

Since death following cesarean section is often not due to the operation itself, Schumann[85] insists that mortality should be assigned to cesarean section only when due to the unavoidable complications of intraperitoneal surgery like pulmonary or cerebral thrombosis, rarely peritonitis, and still more rarely postpartum hemorrhage. After vaginal delivery, he points out, death is assigned according to the underlying cause, as for example, eclampsia, abruptio placentae and puerperal septicemia. Statisticians, however, must assign cesarean section deaths to the international list numbers 149 (other accidents of childbirth), 146 (puerperal hemorrhage), 147 (infection during childbrith and puerperium), and 144 to 148 (the toxemia group).

The puerperal death rate in the United States has decreased 11 per cent from 49 per 10,000 in 1937 to 43.5 per 10,000 in 1938, and it appears that the rates for 1939 and 1940 will be still lower; yet the rising incidence of cesarean section with its high average mortality promises to destroy our obstetric gains. Improved surgical technic has properly widened the range of operation, but appreciation of the importance of contraindications to cesarean section has lagged behind. Those who are unable to assess the risk of cesarean section or are incompetent to weigh its indications and contraindications, should not perform the operation, whatever their technical ability.

INDICATIONS

Contracted Pelvis. In severe pelvic contraction, as a rule, cesarean section is indicated when the child is alive, and craniotomy if it is dead. Infection may be so severe, however, that election of abdominal delivery should be very seriously questioned. When pelvic contraction is so great that vaginal delivery of a dead fetus by embryotomy is not possible, the indication for cesarean section is absolute. Thus, with a diagonal conjugate of 9.0 cm. or less, delivery of a living full term baby is practically impossible, and cesarean section will be necessary. Cesarean section is so clearly indicated in major degrees of pelvic contraction, that it should be elected before labor begins.

In moderate pelvic contraction with a diagonal conjugate between 9.5 and 11.0 cm. cesarean section is often elected, yet spontaneous delivery may follow good labor. In the majority of cases of

minor pelvic contraction, with a diagonal conjugate below normal but not less than 11.0 cm. it is likely that spontaneous delivery will occur. In some cases, however, it is difficult to know beforehand whether pelvic delivery is possible or not. Molding of the vertex is variable and depends on the consistency of the fetal head; and the size of the fetus is an important factor. Presentation and position must be given due weight, and good labor is essential. The patient's age, behavior of the soft parts and the time of rupture of the membranes must also be taken into consideration.

Severe outlet contraction, if established, is a proper indication for cesarean section, yet a narrow pubic arch and short transverse diameter may be well compensated in the hind pelvis. In cases of short bisischial diameter the sum of the bisischial and posterior sagittal diameters should equal 15 cm. for infravaginal delivery to be possible with a baby of average size.

The majority of women with contracted pelvis may be delivered satisfactorily by the vaginal route. Müellers method of fitting the head into the pelvis has some value. If the lowest level of the vertex can be forced into the pelvis as far as or below the level of the spines, good labor should result in vaginal delivery. If overriding cannot be overcome, pelvic delivery is possible though unlikely. Occasionally, the soft parts prevent the fetal head from engaging. Slow dilatation of the cervix is a proper indication for cesarean section only when there is grave doubt of pelvic delivery.

We have become more and more aware of the limitations of pelvimetry by other than roentgenographic methods, yet as a rule the diagnosis of contracted pelvis is made without the use of *x*-ray, and measurement of the diagonal conjugate is generally held to be a reliable index of pelvic capacity. Thoms[94] has said, "A reasonable effort should be made to measure the diagonal conjugate, always remembering that the calculation of the true conjugate may not be accurate, and that marked shortening of the transverse diameter of the superior strait may be present, with no shortening of the true conjugate."

Caldwell and Moloy[10] "are opposed to the use of roentgen methods on the results obtained from mathematical formulations of a few pelvic and fetal diameters." They say that while "exact diameters may be attained by roentgen methods in actual practice, the significance of these measurements is difficult to determine. One of the serious drawbacks to the use of a few cardinal diameters as a

basis for prognosis is the fact that compensatory space does not enter into such calculations." Stereoroentgenography, however desirable, is not as practical for the average hospital as the grid method of Thoms, an excellent and a very much simpler procedure.

Roentgenometric pelvimetry gives us accurate information on the topography of the pelvis, yet the power of the expulsive forces and the capacity of the head for molding and adjustment to the pelvic brim are very difficult to determine; nor can *x*-ray be trusted to provide us with accurate knowledge of the relationship of the size of the fetal head to the pelvis. The patient with the borderline pelvis or cephalopelvic disproportion presents a very serious problem indeed. There can be no doubt that this diagnosis is responsible for a great many unnecessary cesarean sections. Molding of the vertex and engagement itself often occur only after a real test of labor, which may terminate in delivery, or all too often in dystocia, and finally cesarean section performed so late that the risk should not have been taken.

Trial or Test of Labor. At the end of pregnancy, or the beginning of labor, it is often impossible to know whether delivery can occur through the natural channel or not, without the risk of serious injury to the child. A trial of labor is necessary in cases in which disproportion is not great or the available evidence indicates a borderline contracted pelvis. Obstetricians are not of one opinion as to what this trial of labor should be. Whether labor should be allowed to continue long enough to be a real test of the ability of the fetal head to mold and engage in the contracted pelvis is a serious question. The risk associated with a test of labor should not be taken if there is reasonable doubt of pelvic delivery. A difficult second stage with forceps delivery and injury to the soft parts, or with fetal mortality or morbidity, is undesirable. With definite disproportion, trial only should be permitted. It is suggested that this consist of about six hours of fairly active labor, after the regular first stage pains have been established. Overriding or lack of engagement may then be noted by abdominal palpation. Vaginal examination should be avoided, but if the membranes are still intact it may be done if necessary. When the diagonal conjugate is between 9.5 and 10.5 cm., this trial should be sufficient.

If the diagonal conjugate is between 10.5 and 11.5 cm., trial of labor may be allowed to continue as a real test for as long as two hours in the second stage. The endocrinologic and psychic status of

the patient, character of the soft parts, type of labor, size and consistency of the fetal head and presentation and position of the fetus must be given due weight. The experience of the obstetrician is without doubt the most important single factor in assessing the indications and clinical progress of either trial or test of labor.

ANTEPARTUM HEMORRHAGE

Placenta Previa. The first bleeding of placenta previa may be anything from slight spotting to sudden profuse hemorrhage quickly followed by symptoms of shock. Since hemorrhage will surely recur, expectant treatment invites disaster. The patient should be sent to the hospital at the time of her first hemorrhage. The vagina should not be packed, as the pack is commonly ineffective; it introduces infection, and prohibits cesarean section, the treatment of choice for certain cases. Nor should a rectal examination be made, as it may precipitate serious bleeding and generally yields but little information. Even vaginal examination should be carefully considered. Certainly it should not be made at home, nor in the hospital until a suitable donor is on hand and preparations for delivery have been completed. It may not be necessary if a clear history and other important data indicate placenta previa, and that the patient should be delivered by cesarean section.

Successful treatment depends primarily upon the condition of the patient and the good judgment of the obstetrician. Parity, the character of the cervix, the amount of placental tissue in the birth canal, the duration of the pregnancy and the size and viability of the fetus must all be considered. The condition of the cervix is more important than the degree of placenta previa. It must be recognized of course that a high fetal death rate is inevitable since the fetus suffers from anoxemia or actual anemia if placental separation is considerable. Further, many babies are not viable or barely so, and the premature fetus, though viable, is a poor subject for vaginal manipulation of any kind.

Abdominal delivery gives the baby the best chance for survival yet it often increases maternal risk. It is contraindicated if the fetus is not clearly viable, or if vaginal packing or manipulation of any kind has been carried out, other than a careful vaginal examination made in the operating room just prior to operation. When the baby is not viable or dead, or all but dead as indicated by the character of the fetal heart, other methods of treatment are indicated.

Cesarean section is best for all patients who have had exsanguinating hemorrhage, except when it appears that simple rupture of the membranes will be sufficient. There is general agreement that cesarean section, as a rule, is the best method of delivery in cases of central placenta previa, and in primiparae near term when the cervical os is partially covered by placenta. It is our own practice to perform lower segment cesarean section in all cases not definitely known to be marginal when the cervix is long or uneffaced, the baby viable, and the patient is not in labor.

Delivery by cesarean section reduces blood loss and hemorrhage can be more certainly controlled. If the operation is performed through the lower segment, the placental site may be packed and active bleeding from large sinuses may be stopped by suture. Infection, in the absence of vaginal pack or manipulation, is minimized. Fetal mortality will be definitely reduced, if the nonviable fetus is not given undue value.

Ablatio Placentae. The result of treatment depends largely upon whether hemorrhage is frank or concealed, and the amount of blood loss. The importance of blood transfusion is obvious. In serious cases, Stander[92] believes that cesarean section should be performed if the patient is not in labor, and the uterus retained or removed "according as it contracts satisfactorily or remains atonic; the same applies even if labor is already in progress, unless the cervix is partially dilated and an early vaginal delivery may be expected."

There is a broad indication for delivery just as in eclampsia in which the method of delivery is equally important; yet as in eclampsia, the condition of the patient is more important, and mortality may be actually due to treatment. The fetal mortality is notable, and with it comes the implication that the child should be disregarded in selecting the type of treatment. However, this is no more true in ablatio than it is in placenta previa. Certainly, if the baby is alive and viable, and delivery can not be effected speedily from below, abdominal section should be performed if the patient's condition will permit.

Actually few patients need cesarean section and certainly not those already in severe shock, nor those threatened with the uremia or anuria of chronic nephritis. If cesarean section is performed, it should be the lower segment operation under local anesthesia. Uteroplacental apoplexy can not be diagnosed without opening

the abdomen. Though accidental hemorrhage does predispose to postpartum bleeding, hysterectomy should be performed only for persistent hemorrhage. The Couvelaire uterus of itself is not an indication for hysterectomy.

Most cases, even severe ones, properly fortified by adequate transfusion, will do best with conservative treatment. Irving's[49] impressive experience with radical and conservative methods of treatment confirms this opinion.

Pelvic Tumor. Fibroids should not be removed during pregnancy. Though degeneration of a tumor may from time to time give rise to severe pain, often accompanied by leucocytosis, elevated temperature, localized tenderness and signs of peritonitis, these symptoms will subside under conservative therapy and neither myomectomy nor cesarean section are indicated. Occasionally, if the tumor is pedunculated, torsion may occur, and myomectomy will then become necessary.

Tumors of the uterus may seriously complicate labor or so obstruct the pelvis that delivery from below is impossible. In the vast majority of cases, however, they do not. Fibroids which, from their size and location, appear to create a real problem often rise from the pelvis in the latter weeks of pregnancy or even after labor has begun. Decision as to cesarean section should be reserved until then, and the patient given a trial of labor, not a real test, for the risk increases rapidly. In the majority of cases in which the tumor is found in the pelvis at the onset of labor, cesarean section is indicated. The large posterior cervical fibroid is the most dangerous, as it is least likely to rise out of the pelvis during labor. Dystocia or subsequent lochiastasis commonly result.

Multiple fibroids, or a large solitary tumor in the fundus of the uterus may be the cause of poor labor and slow dilatation of the cervix. Generally within a few hours it will be possible to note whether descent of the presenting part is progressing or not. If labor is good, and descent steady, labor should be allowed to continue without intervention, for pelvic delivery is safer; and operation for the fibroids, if indicated, is better done after involution has been completed. If cesarean section is elected, the question of hysterectomy or myomectomy always arises, and is not too readily answered. It is clear that myomectomy, unless for a pedunculated growth, carries with it considerable risk arising from hemorrhage and proximity of the myomectomy field to the bacteria laden cavity of

the uterus. Removal of multiple fibroids should not be considered at this time. Hysterectomy is a much safer operation, and smoother convalescence may be expected than after simple cesarean section. Hysterectomy should be performed, however, only after full consideration has been given to the number and location of the tumors, their probable effect on uterine drainage, the risk of postpartum hemorrhage and subsequent sterility.

Ovarian tumors are serious complications of pregnancy, labor and the puerperium. Torsion of the pedicle with rupture of the tumor due to twist or pressure may cause death. During pregnancy they should be removed as soon as possible after the third month. If found during the puerperium, laparotomy should be performed at once. If discovered first during the course of labor, the abdomen should be opened for removal of the tumor, and the patient allowed to deliver herself, if no other cause for dystocia is present. If found late in labor interfering with descent of the presenting part, no attempt should be made to push the tumor out of the pelvis as it may rupture; and on no account should the fetus be drawn past the tumor by forceps or traction on the feet. The abdomen should be opened, the tumor removed as quickly and as gently as possible, and delivery completed from below in the best way possible.

Occasionally, carcinoma of the cervix becomes a proper indication for cesarean section. Advanced disease forbids vaginal delivery with its associated laceration and hemorrhage. Cesarean section is performed purely in the interests of the baby, after every effort has been made to carry it to viability, the time of election depending upon the general physical condition of the patient. Since the danger of spread of cervical infection to the body of the uterus is a real one, hysterectomy with careful peritonealization of the cervix should follow cesarean section whenever it is feasible. This procedure appears to be safer than total hysterectomy.

Rarely neoplasms of the vagina or bony pelvis, or tumors not connected with the generative organs, as kidney, spleen, bladder or rectum make cesarean section necessary.

Abnormal Presentation. Clearly the presentation and position of the fetus must receive thoughtful consideration in every case in which vaginal delivery is in doubt, yet cesarean section is not warranted for these indications alone. Nor is the expectation of long labor a proper indication. Slight increase in fetal risk does not justify the risk of cesarean section, yet this risk may be properly assumed by

the patient when her age makes the probability of another pregnancy unlikely.

Transverse presentation in the primipara is sufficient to indicate pelvic contraction. Cesarean section is indicated, since pelvic delivery is always operative, and commonly associated with serious injury to the maternal soft parts and fetal morbidity and mortality as well. It is not an indication for cesarean section in multiparas with good obstetric history. Cesarean section is better than version or decapitation for an impacted shoulder, when the mother and baby are in good condition. The danger of fatal peritonitis is great, yet the risk compares favorably with other methods of treatment and cesarean section gives the baby its best chance for survival. Hysterectomy is generally indicated.

Presentation of face or brow in the primipara is likewise an indication of contracted pelvis or cephalopelvic disproportion. It is important to remember that the association of fetal malformations is as high as 10 per cent. Cesarean section is indicated for the same reasons as in transverse presentation. If, with intact membranes, progress is steady, a fair test may be advisable, depending upon the size of the baby and the character of the labor. If progress is not made, and this is most likely in posterior positions, a careful vaginal examination will indicate the course to be followed. If rupture of the membranes occurs with a posterior face presentation, an immediate attempt at conversion to a vertex or rotation to an anterior face should be made, if abdominal delivery is not indicated.

Breech presentation in the primipara implies considerable fetal mortality, yet of itself it is not an indication for cesarean section. Prophylactic version in the antepartum period is recommended. Unengagement of the breech before labor begins is of no importance. In the absence of pelvic dystocia good labor will accomplish delivery. With a large fetus in frank breech presentation and minor pelvic contraction the patient's age may properly be taken into consideration.

Postoperative Dystocia. The end results of previous pelvic surgery may cause dystocia, but as a rule the circulatory changes of pregnancy bring about softening and relaxation of tissues sufficient to allow pelvic delivery. Rigidity of the soft parts is rarely so great that it cannot be overcome by the advance of the presenting part.

Extensive cicatrices of the vagina following repair of vesicovaginal or rectovaginal fistulas make elective cesarean advisable. Previous perineorrhaphy, however, or even plastic repair of a third

degree tear, unless the rectal repair was high, may be adequately protected during pelvic delivery.

Prior amputation of the cervix, or deep cauterization may result in scar formation so dense that rupture of the uterus may occur during labor. Partial amputation of the cervix as in the Manchester-Fothergill operation for prolapse of the uterus should not interfere with pelvic delivery.[30] In any event, trial of labor is advised, with careful observation of the progress of cervical dilatation. In the absence of previous operative procedures there can be no true cervical stenosis. Histologic examination of cervices from patients in whom dilatation occurred slowly has shown no significant structural alteration. Without question uterine inertia is the cause, and cervical stenosis has now ceased to be a common indication for cesarean section.

Fixation of the fundus of the uterus to the abdominal wall may so distort the birth canal, that delivery, unless by cesarean section, is impossible. Trial of labor is indicated, however, and should be prolonged in those cases in which the cervix is not displaced posteriorly and when its axis is in relation to the parturient axis.

Previous myomectomy is a competent cause for rupture of the uterus, yet cesarean section is not always indicated. If the operation had been performed for a pedunculated fibroid, or a tumor near the isthmus or cervix, or if the cavity of the uterus had not been widely opened, pelvic delivery is advised. After multiple myomectomy, as a rule, cesarean section should be elected. The size and number of the myomas excised, the depth and sites of uterine incisions, the occurrence of postoperative morbidity and the care with which the uterine wounds have been sutured are of importance. It would be wise for the gynecologist who performs a myomectomy on a patient in the child-bearing age to record these data on the patient's chart, with his opinion as to whether cesarean section is advisable in future pregnancies.

Fetal Indication. A great many unnecessary cesarean sections are performed in the interests of the child. Intervention occurs particularly for uterine inertia or after a trial of labor, too long or perhaps too short, or when dilatation of the cervix has been slow. It is true that any complication of labor in which pelvic delivery gravely threatens the life of the child may be a valid indication for cesarean section, but not when the maternal risk is excessive or the baby's chance for survival not good.

Prolapse of the cord or forelying cord is a generally accepted indication in the primipara with a viable baby. If the cord lies outside the vulva, it should not be pulled through the uterine incision, but cut close to the placenta and delivered from below, though this may not often be feasible.

Habitual death of the fetus before labor begins is a good reason for cesarean section. One previous stillbirth with a history of normal or even difficult labor is not a valid indication. After close inquiry into the facts and circumstances of the previous pregnancy and delivery and careful antepartum examination, pelvic delivery may often be awaited with confidence. In any event, a trial of labor is indicated. A history of two or more stillbirths is sufficient reason in most instances for elective cesarean.

The old primipara may be properly considered here. Occasionally, labor may be surprisingly short, yet on the whole the duration of labor does increase with age. However, the incidence of cesarean section should not increase with age alone. When a trial of labor shows that labor will be protracted and the patient may lose the only baby she may ever have, cesarean section is indicated.

Excessive size of the child, particularly when associated with prolonged postmaturity may cause serious dystocia. If, after trial of labor, the head is not engaged, cesarean section is warranted.

Previous Cesarean Section. The nature of the reparative processes in the uterine wound is of considerable importance in the decision to elect another section. Kerr[54] states that Couvelaire, Gamble and McIntyre have shown that the wound heals by fibrous tissue replacement of muscle fibers. Schwartz, Paddock and Bortnick[86] found that healing takes place chiefly by proliferation of fibroblasts in the spaces between the muscle bundles. Stander[92] believes that the uterus, like all other organs made up of nonstriated muscle heals by regeneration of muscle fibers, not by scar tissue, and that in the absence of infection, and with proper suturing the risk of rupture is minimal.

Kerr[54] contends that no matter how carefully the upper segment has been sutured the risk of rupture is always present for these reasons: (1) The wound is very apt to become infected; (2) the involuting muscle fibers are degenerating; (3) the wound area is in a state of unrest especially for the first twenty-four hours, with sutures loosening and gaping a little; (4) the sutures necessarily function for both coaptation and hemostasis, yet the muscle fibers are irregularly

distributed and exact approximation is difficult, so that blood pools here and there, to be replaced by fibrous tissue later; (5) since the placenta occurs on the anterior wall in 40 per cent of the cases, it is difficult to make wound edges meet exactly, because the undermost part is friable due to the presence of large sinuses; this favors gutter formation with weakness of the scar and hernia of the membranes into it in late pregnancy; and (6) if in later pregnancy the placenta forms over this scar, destructive action of the trophoblast on fibrous tissue favors rupture.

In a certain percentage of cases rupture will occur during pregnancy or labor. Symptoms are often slight, and the patient may not die from hemorrhage or sepsis, but the child is usually lost. It is very likely that rupture occurs in the upper segment more often than in the lower. Holland,[44] in the first collective study of ruptured scars, found 4 per cent of ruptures after the classical operation. Wetterwald,[98] in 1926, in 3,600 lower segment operations, and Gelle,[27] in 1932, again collecting all available cases reported approximately the same percentage of rupture, 0.25 per cent.

Irving[48] reporting their experience at the Boston Lying-In Hospital, states that from 1929 to 1938, fifty-five women who had had previous cesarean sections were delivered pelvically seventy-three times, one patient five times. If the operation had been performed in their hospital for a temporary indication they "are disposed to allow labor under careful supervision; otherwise cesarean section is repeated." Lazard,[58] however—and we know of similar cases—saw a patient who had three difficult pelvic deliveries after she had been sectioned in her second pregnancy for an overlarge fetus, die in her sixth pregnancy before she could be operated upon for complete rupture of the old cesarean scar. "Once a cesarean always a cesarean" if rigidly followed as a dictum results in a steadily increasing number of cesarean sections, with increased risk in secondary operations. In 1938, Fraser and Sparling[26] in their series found 21.9 per cent were for previous cesarean section; in 1927, the percentage was but 12, whereas in 1936 it had risen to 34. Daily,[14] in 1939, analyzing 1,000 consecutive cesarean sections at the Chicago Lying-in found that 27.9 per cent had been sectioned before. Matthews and Acken[65] in a critical survey of 1,066 cesarean sections found a greater incidence of sepsis and poorer results in repeated operations, with all the mortality in the classical group.

For the most part obstetricians are of the opinion that a carefully supervised trial labor is reasonably safe if the indication for the previous cesarean section is not present and the postpartum course had been normal. This is particularly true of the lower segment operation. If labor has begun and satisfactory progress is being made, careful observation and pelvic delivery aided by forceps is the treatment of choice. Some disagree completely with this point of view, and others seek a compromise. Plass,[76] for instance, thinks that if the first operation was performed while the patient was still a primagravida, and not in labor, it is unwise to risk vaginal delivery; but if the operation had been performed on a parous woman for some complication, pelvic delivery would be more reasonable and frequently conducted safely.

It should not be forgotten that rupture of the uterus is a very real danger, not to be discounted. Afebrile convalescence is no guarantee of a scar that will not rupture. No recent statistics on this important subject have been published, yet there is increasing evidence that the dictum, "once a cesarean, always a cesarean," must be modified.

The following factors must be weighed in arriving at a decision:

1. *The Type of Previous Section.* It is certain that the scar following the classical operation is more likely to yield than that following the lower segment operation. A vertical incision in the lower segment is likely to give rise to a weaker scar than the transverse incision because of the almost constant inclusion of part of the corpus uteri in its upper end. When rupture does occur after the lower segment operation with vertical incision, it can generally be demonstrated that the upper end of the scar yielded first.

2. *The Presence of Previous Postoperative Morbidity.* If infection of the uterine incision has occurred in a previous section, firm healing of the scar is interfered with and a weaker scar results. Even though a febrile puerperium cannot be shown to be due to uterine infection, the existence of a weak scar should be assumed.

3. *The Occurrence of Previous Infravaginal Delivery.* If all previous deliveries, one or more, have been by cesarean section, so that no previous preparation of the lower birth passages has ever occurred, the strain on the uterine scar during the second stage of labor is likely to be increased.

It would appear that there is little reason for cesarean section under the following circumstances: A multipara who has had at least one spontaneous delivery of a normal sized living child without

protracted labor, who has also had a previous lower segment cesarean section with transverse incision without postoperative morbidity and in whom the indication for the previous section is not present.

It is not safe, however, under any circumstances to risk infravaginal delivery after previous cesarean section unless the patient is carefully observed for signs of uterine rupture during her entire labor in an institution at which facilities for immediate cesarean section and blood transfusion are available.

MEDICAL COMPLICATIONS

Cardiac Disease. Women with cardiac disease are not good risks for parturition, yet it does not follow that cesarean section is indicated. In fact, unless there is definite evidence of major damage to the heart, cesarean section should not be performed for cardiac disease alone. Patients with heart disease, except those who are clearly bad risks, do well in labor, if the first stage is conducted under morphine analgesia, and delivery by forceps effected promptly in the second stage under local anesthesia. If dystocia develops early in labor, cesarean section should be more seriously considered. Disproportion and poor labor are of course important factors in judgment.

In general, when it appears that cardiac reserve is so low that the patient might not survive a comparatively easy labor, cesarean section should be elected as near term as possible. Local anesthesia is best, and open drop ether next in safety. Other anesthetics are more dangerous.

Operation should be performed only after the patient has been made a reasonably safe risk. It is certain that the actual load of pregnancy on the circulation does not increase progressively with the months of gestation. Failure is commonest, it is true, in the last trimester, yet clinical improvement may be confidently expected in the last few weeks before term. It is of the utmost importance that this optimum time be awaited. Hamilton[36] has shown this very clearly, and our experience over a five-year period with a large number of well supervised cardiac patients is the same.

Hamilton points out, too, that infant mortality is very high if delivery occurs before the last two or three weeks. After eliminating the very bad risks in all his cases of pregnancy with evidence of serious heart damage, he found that five patients in his first 750 died of puerperal sepsis, one in 600 deliveries from below, and four in 150 delivered by abdominal hysterectomy. Whether women with cardiac

disease have increased susceptibility to infection after cesarean section is not certain, yet this added risk must be given due weight.

Tuberculosis. Consideration of cesarean section as a method of delivering tuberculous women depends largely upon the presence of exudative or pneumonic tissue reactions. The extent of involvement of the lungs is of less importance. With proper treatment the productive fibroid lesion may even improve during pregnancy, and parturition may present no major problem in the absence of long labor, hemorrhage or infection. On the other hand the labile pulmonary lesion, however small, is a serious complication of pregnancy, and women with active lesions should spend their entire antepartum period in the hospital under the care of the internist and obstetrician.

Since it appears that a comparatively short labor carries with it less risk than cesarean section, the method of delivery should not be definitely selected in any case until term, or after trial of labor. Disproportion, early rupture of the membranes, and dystocia due to soft part interference or abnormal presentation assume increased importance. In women with healed lesions, or those in whom tuberculosis has been inactive for some time, cesarean section need not be considered. Shortening of the second stage of labor by forceps delivery under local anesthesia is usually advisable. Prolonged rest with artificial pneumothorax and other forms of modern tuberculosis therapy postpartum are important, whether cesarean section has been performed or not.

Diabetes Mellitus. It is clear that certain diabetics had best be delivered by cesarean section. Selection of such cases is often so difficult that only when maternal or fetal death has occurred after pelvic delivery does it become obvious that cesarean section should have been elected. Indications for cesarean section may be maternal or fetal, or both. The fetal indication is at present not only the most usual, but is held by some to be the only one.[66]

Maternal Indication. With the introduction of insulin the incidence of pregnancy in diabetic women has materially increased, and the problem of the proper care of the juvenile diabetic is more often encountered. These patients run the greatest risk in parturition. The diabetic who is permitted to go into labor must be observed carefully, preferably by an internist, and particularly when labor is prolonged. Early exhaustion of glycogen reserve may produce hypoglycemia; and starvation, vomiting and anesthesia may produce

ketosis. Proper insulin dosage during labor is difficult to determine and hourly estimation of the blood sugar may be necessary in severe cases. Two important co-efficients must be considered before electing cesarean section in the interest of the mother:

1. *The Diabetic Factor.* The juvenile or severe diabetic is most difficult to treat safely during labor, since she may die of diabetes even though the obstetrician be assisted by the most expert internist. The nonjuvenile or nonsevere diabetic may generally be allowed to deliver infravaginally under local anesthesia.

2. *The Obstetric Factor.* Expectation of prolonged or difficult labor should aid in the election of cesarean section. Thus the primipara with juvenile diabetes and late engagement of the head at term, is best managed by cesarean section, while pelvic delivery is indicated in a multipara with nonjuvenile diabetes, and no other obstetric complication.

The Fetal Indication. Fetal mortality in diabetics, estimated recently as high as 40 per cent, is due principally to intrauterine death during the last few weeks of pregnancy.[78] Joslin[50] has shown that stillbirths occur three to six times as frequently in the diabetic as in the nondiabetic. Overgrowth of the fetus often precedes death. White and Hunt[100] are able to predict premature delivery, stillbirths and neonatal deaths by an abnormal rise of the chorionic gonadotropin after the twentieth week to a level of 200 rat units, and claim that these accidents can be prevented by administration of huge amounts of estrogen and progesterone, too large at the present time to be available to the general profession.

Cesarean section two to four weeks before term is advised by some authorities in an effort to ensure safe delivery of a viable fetus. Determination of the proper time may be supported by the use of the *x*-ray. Suprapubic delivery is indicated when the fetus is abnormally large or further opportunity for pregnancy is unlikely. If laboratory facilities are available for demonstrating abnormal hormonal behavior, prediction of intrauterine death should aid in the election of cesarean section. Since infants of mothers with diabetes mellitus show a high mortality rate, especial care must be given the baby after delivery or the purpose of the operation will be defeated.[90]

In any case both maternal and fetal indications must be considered jointly. It would appear that cesarean section is indicated in the primipara with severe diabetes since childhood, when prolonged labor is likely.

Other Indications. Cases of pelvic exostoses, bony tumors, healed fractures of the pelvic bones, ankylosis of the hip, spondylyolisthesis, osteomalacia and kyphosis are not of themselves indications for cesarean section. They necessitate expert pelvic roentgenography before a decision can be made. Previous spontaneous labor may have occurred, yet section may be indicated in a subsequent pregnancy.

Uterus bicornis or didelphys is generally not a cause for dystocia though the nonpregnant horn or uterus may block the birth canal and necessitate suprapubic delivery. Cesarean section may also be indicated in cases in which postpartum lochiastasis with subsequent puerperal sepsis is anticipated. When section is done for this indication, either the pregnant or nonpregnant horn or uterus should be excised. The latter procedure is recommended.

Hypopituitarism with the dystrophia dystocia syndrome of DeLee may be a proper indication for abdominal delivery when associated with severe uterine inertia or primiparity late in life.

Postmortem cesarean section, according to Stander[92] is not recommended, since it is usually unsuccessful in saving the life of the baby and because of the "abhorrence in which it is more or less justly held by the laity." However, others are of the opinion that the physician is morally obligated to try to save the life of the child after the death of the mother. Twins have been saved this way.[38] DeLee[16] approves of this procedure and says "It is not even necessary to obtain the consent of the husband or the family, though for his own protection, the accoucheur should get it if possible."

CONTRAINDICATIONS

In the absence of a definite indication, abdominal delivery should not be considered. Cesarean section is a major operation with unparalleled risk of excessive hemorrhage, postoperative shock and peritonitis. It is so dangerous that those who are not competent to weigh the relative merits and disadvantages of pelvic and abdominal delivery in a given case, no matter how capable they may be as operators, should not feel called upon to perform the operation. To attempt the operation in poor surroundings and without adequate assistance is to court disaster.

Cesarean section is generally contraindicated when the fetus is known to be dead, unless no other method of delivery is feasible or as safe. When cesarean section is done for fetal indication, the risk should not be taken if the chances of survival of the baby are not

thought to be good. Nor is cesarean section justifiable for the sake of the baby, when maternal death would appear to be a probable result of this procedure.

Actual infection is a contraindication. Ideally, there should be no suspicion of infection, no long labor or exhaustion, no attempt at induction of labor or delivery and no concurrent febrile disease. The fundamental prerequisites for the success of any laparotomy have increased importance in abdominal delivery. Cesarean section may be elected because of greater danger from the alternative treatment, yet the outcome becomes more and more doubtful when any of these contraindications are disregarded.

In the presence of exsanguination, exhaustion and acidosis, cesarean section is contraindicated until the patient is properly prepared for operation.

Every vaginal examination increases the risk. Pathogenic organisms may be present without febrile reaction. Patients who have been subjected to repeated vaginal examination, even when made under carefully controlled conditions, are very poor risks.

Rupture of the membranes for more than a few hours invites infection of the amniotic sac and the uterine cavity. Invasion of the placental bed by virulent organisms may be responsible for death of the baby a few days later.

Induction by catheter or bag, no matter how expert the operator or how scrupulous his technic, prohibits cesarean section. Attempts at forceps delivery or version are even worse.

Acute and chronic nephritis contraindicate cesarean section, yet at times compromises must be made.

The operation should not be performed for the purpose of interrupting pregnancy during the last trimester, or to accomplish sterilization. And, as a matter of fact, the risk should never be taken simply to sterilize a patient who is capable of vaginal delivery.

In eclampsia, cesarean section is definitely contraindicated. In Brooklyn[32] from 1921 to 1926, the mortality of cesarean section for eclampsia was 26 per cent in 104 cases, and in New Orleans[70] for the same period 41.5 per cent in forty-one cases. In 1940, King[56] comparing two cesarean section surveys carried on in New Orleans showed a reduction in the maternal death rate from 16.1 in the first period (1921 to 1926) to 5.9 per cent in the second (1926–1936). This notable reduction was largely due to the partial elimination of eclampsia as an indication for cesarean section. There are no modern

statistics which justify the performance of cesarean section after the onset of convulsions.

If cesarean section should be performed for pre-eclampsia, great care and good judgment will be necessary in the selection of cases, else the mortality will be high. The patient must not be in labor. In fulminating cases the operation may precipitate the convulsive seizures that we wished to avert. When all other methods of treatment have failed to bring about improvement in the patient's condition, or when she grows worse in spite of treatment, there is an occasional indication for cesarean section in the primigravida with an intact cervix near term and not in labor. On no account should the operation be performed under general anesthesia. Local anesthesia should be chosen.

PREPARATION FOR OPERATION

Preoperative care for cesarean section includes the usual preparation for laparotomy as well as operative delivery. In elective section it is well to have the patient admitted to the hospital a few days prior to operation. General physical examination is necessary and careful observation for respiratory infection is important. She should have previously been warned against the dangers of douches and coitus during the last month of pregnancy.

Roentgenography is an additional safeguard in the occasional case in which gross malformation such as anencephalus, hydrocephalus or spina bifida are unsuspected. If the operation is to be performed chiefly in the interests of the baby, these malformations are of great importance. Occasionally, twins or prematurity may be diagnosed in this way when clinical data are uncertain, and plans for cesarean section as well as the time of operation may be influenced.

On the day before operation the abdominal and pubic areas should be shaved, the skin washed thoroughly with soap and water and sterile dressings loosely applied to the abdomen. In the operating room, a wide operative field from breasts to thighs, paying special attention to the entire mons veneris may be sponged with ether, and lightly painted with one of the newer antiseptics. In elective section an enema should be given on the day before operation, but no cathartic; no other enema is necessary or advisable.

Immediate preoperative medication may include only atropin gr. $\frac{1}{150}$. Morphine is not without danger for the baby. Pituitrin,

ergonovine, and morphine for hypodermic use should be quickly available during the operation.

Precaution should be taken to ensure an empty bladder at the time of operation. The catheter should be left in place, and open if desired. If care is not taken, the partially filled bladder may make exposure of the lower segment difficult; or it may be inadvertantly incised when the abdomen is opened. Bladder injuries during the lower segment operation occasionally occur and are largely due to neglect of this precaution.

Final auscultation of the fetal heart should be performed in the operating room, since fetal death will usually make cesarean section unnecessary. If the heart sounds had previously been easily heard, their absence is good evidence of fetal death.

The operating room itself is of great importance. If a series of operations are to be performed in the same room, cesarean section should be scheduled first. Section should never be performed in a room just previously contaminated by another operative procedure. Proper masks covering nose and mouth of everyone in the operating room including the anesthetist are of vital importance. Those with respiratory or skin infections should not be permitted to enter the room, unless they have been shown by bacteriological cultures to be innocuous.

The obstetrician will need three assistants and two nurses at the operation. It is the sole function of one assistant, who has been trained in management of birth apnea, to take care of the baby. Resuscitation apparatus, oxygen and warm blankets should be available. A special table should have on it a tracheal catheter, cord tie, sterile dressings, 1 per cent silver nitrate, clamps and scissors. The second assistant will manage retractors and the second nurse will circulate.

Preoperative vaginal instillation of antiseptics like 3 or 4 per cent mercurochrome or 1 per cent neutral acriflavine in glycerine have been advocated. Brown,[9] in a series of 144 cesarean sections demonstrated that antiseptic vaginal instillations definitely lowered the incidence of morbidity and mortality. Since our own figures for febrile morbidity and mortality have been very low without their use, we do not believe that this procedure is necessary.

Trendelenburg position is very helpful in keeping intestines out of the operative field and making the lower segment more accessible. When infection is suspected, however, the head of the operating

table should be lowered no more than is actually necessary for this purpose, or it will become more difficult to prevent infected amniotic fluid from reaching the upper portion of the abdomen.

If cesarean section is to be performed soon after admission to the hospital for an urgent indication, great care should be taken to discover whether the stomach is empty or not. If the patient has had a meal shortly before, a stomach tube should be quickly passed and the stomach emptied. This is important, whether general or local anesthesia is planned, and it is absolutely essential if a general anesthetic is to be administered. Death from vomiting and aspiration of stomach contents during general anesthesia is not uncommon.

BLOOD TRANSFUSION

Because of the ever present danger of hemorrhage during the course of cesarean section or immediately afterward, full preparation for blood transfusion should be made prior to operation. After typing and crossmatching, a suitable donor should remain in the hospital until the operation is completed and the patient safely back in her bed. If a blood bank is available, similar preparations regarding the accessibility of compatible blood should be made. In any case, institutions where cesarean sections are performed should at least have blood plasma or serum available since these are now easily procured and may be kept safely for long periods of time.

Adequate replacement of blood loss during cesarean section and the treatment of shock are of great importance. Analysis of deaths following cesarean section show that hemorrhage and shock contribute heavily to the mortality; and, in sepsis, the most common cause of death, the anemia resulting from hemorrhage is often a strong predisposing factor.

As a result of recent work on the functional and structural changes following hemorrhage and shock, we can now more fully appreciate the great importance of speedy and adequate replacement of blood loss.[69] It has been shown that the use of intravenous crystalloid solutions such as dextrose and saline dextrose have only a temporary therapeutic effect. In shock they increase blood volume for a short time only, quickly diffusing through abnormally permeable capillaries.[60]

When hemorrhage is serious there is no question but that transfusion of whole blood is best. However, delay in securing compatible blood may be sufficient to allow for irreversible changes in

the capillary bed so that when finally given it may be too late to save the patient. When a blood donor is used, a delay of two to four hours is not unusual. The many benefits that a large hospital may derive from a blood bank are already well known but even there the interval of time elapsing between the call for blood and the transfusion averages about forty minutes.

The answer to the problem lies in the use of blood plasma or serum. Collection and administration of blood plasma are simple, requiring no complicated apparatus. Blood may be drawn into a vacuum flask containing anticoagulant such as sodium citrate, and allowed to stand in the refrigerator until the plasma has separated. The supernatant plasma is then aspirated into another vacuum flask containing a quantity of saline equal to the volume of plasma introduced. The addition of the saline solution tends to keep the plasma in solution.[87]

No typing or crossmatching of the plasma is necessary[13,8,21,93,97] and there are reports in the literature which indicate the absence of harmful reactions.[2,39] There is evidence to indicate that it is best to pool plasma for adsorption of agglutinins.[40]

There is no reason why even the smallest hospital should not have blood plasma immediately available for use in the operating room. Should an institution be unable for some reason to collect its own blood plasma, it can be secured commercially at reasonable cost in fluid or powder form. The intravenous use of blood plasma is ideal in the treatment of shock not accompanied by severe hemorrhage, since in these cases it is depletion of plasma that must be combated. Actually, hemoconcentration may contraindicate the use of blood. In the case of severe hemorrhage, plasma should be given during the usual delay that accompanies preparation for transfusion of blood.

ANESTHESIA

Many methods of anesthesia have been used. When surgical risk is normal, general anesthesia is satisfactory in that it ensures adequate relaxation and dispels the patient's fear of operation. However, a general anesthetic of any type is a dangerous and profoundly toxic drug and great care must be taken in its administration. Further, it may not be given to women with upper respiratory complications, cardiac disease, tuberculosis or toxemia; and the margin of safety is small when hemorrhage has been considerable or the patient has been long in labor. All inhalation anesthetics pass

through the placenta to the fetus and may make resuscitation difficult.

Ether causes a notable increase in relaxation of the uterus, just before and for a few hours after removal of the placenta, and atonic hemorrhage is common. In our experience it causes more bleeding than any other type of anesthetic. Firm uterine contraction is delayed, placental separation unduly prolonged and blood loss may prove fatal.

Nitrous oxide produces analgesia by a steadily increasing anoxia. Since anesthesia is possible only when concentration approaches 100 per cent, the danger to the fetus is obvious. When used in the induction of anesthesia and preceding the administration of ether, the obstetrician must be vigilant lest it be used with less than 25 per cent oxygen, for stillbirth, or neonatal death a few hours or a few days after delivery may be the direct result of its administration.

Ethylene is better than ether if local anesthesia has failed or can not be used for what appears to be good reason. Cyclopropane would seem to have few contraindications in obstetrics because of its ease of induction with an adequate oxygen supply and low toxicity. Relaxation is better than with ethylene and approaches that of ether. Since anesthesia is produced in concentrations even lower than 10 per cent, it is clearly very potent, and may produce untoward effects on mother or baby even though alveolar oxygen is adequate. Our present knowledge of its action on the circulatory system is so inadequate that its use in cesarean section for cardiac disease is highly debatable. Furthermore, anesthetic mixtures with cyclopropane are explosive.

Obstetricians with but few exceptions agree that spinal anesthesia in cesarean section is dangerous and carries the greatest risk of mortality from anesthesia. Yet it can not be denied that it has very definite advantages. Anesthesia is so deep and abdominal wall relaxation so profound that the operative procedure is simplified.

Cosgrove, Hall and Gleeson[11] have reported 244 cesarean sections performed under spinal anesthesia with no mortality attributable to the anesthetic, and believe that this series is large enough to refute statements that this method of anesthesia is dangerous in cesarean section. Arteriosclerosis, they say, is the only contraindication. The uterus contracts promptly, manual removal of the placenta is rarely necessary and delayed hemorrhage is uncommon; it is

probable, too, that its use is not harmful to the baby, all decided advantages.

However, it is generally agreed that the mortality directly due to its use is highest in pregnant women. It is likely that women at or near term are particularly vulnerable. DeLee,[18] a consistent objector to its use, states that since its dangers are so well known, no spinal anesthetic should be used in obstetrics. He believes that during labor the changes in blood pressure are marked, and that changes in intraspinal pressure are rapid and profound; sudden emptying of the uterus changes pressures and currents, and the resultant drop in blood pressure may be simultaneous with the fall due to the anesthetic. This is particularly dangerous if there is hemorrhage.

Marshall[64] in his excellent monograph on lower segment cesarean section quotes Franken[24] as collecting case reports of 2,000 cesareans performed by twenty operators, with fourteen deaths attributable to the spinal anesthetic alone. In Franken's own clinic 1,000 gynecological operations were performed safely under spinal anesthesia, yet the first patient with a cesarean section died. Marshall says that his own experience leaves him no doubt that spinal anesthesia is particularly dangerous in cesarean section, and that "Any obstetrician who sets out to perform a large series of cesarean sections under spinal anesthesia must be prepared to face a possible mortality of not less than one per cent due to this cause alone."

According to CoTui[12] it is the consensus of opinion that the action of the drug is more inconsistent than might be expected, and that the anesthetic level is unpredictable. He is sure that the physiological problem is not simple and can barely be outlined. Gravitational current, curvature of the spine, pulsations of intradural contents, fixation, destruction and absorption of the drug all need to be further studied.

Babcock[4] says that "The dangers of spinal anesthesia lie more in the user than in the drug. . . . Especially to be feared is the novice who does not know how to watch for and meet emergencies. . . . For spinal anesthesia to be safe, the anesthetist must constantly watch the patient during the anesthesia in order instantly to detect and combat conditions that presage arrest of respiration or circulation."

Since the great majority of authorities agree that spinal anesthesia is an exceedingly dangerous anesthetic for the obstetric patient, it is inadvisable for the occasional obstetric operator to

employ this method of anesthesia routinely. The attitude and experience of the general surgeon with the use of spinal anesthesia are of no value because the obstetric problem of abdominal delivery is in no way comparable to ordinary surgical problems. Secondary respiratory failure based on primary circulatory failure is the cause for death, and apparently pregnancy predisposes to this danger.

It is our opinion that rectal or intravenous anesthesia have no place in cesarean section.

Local anesthesia is the anesthetic of choice for cesarean section because it is safest for mother and baby. In DeLee's[15] clinic more than 1,500 cesareans have been performed under local anesthesia, with no death due to the anesthetic. There are no contraindications to local anesthesia but there are limitations. An extremely apprehensive or restless patient might better be operated upon under a general anesthetic; and in the presence of peritoneal adhesions, or when unusually extensive procedures requiring complete relaxation are planned, as in extraperitoneal section, a general anesthetic had best be used.

The only real argument against local anesthesia is whether or not one can obtain adequate anesthesia with this method. The fault is generally not with the anesthetic or procedure but with the operator. Its technic demands proper administration of the drug, patience in awaiting its full effect and the utmost gentleness in the handling of tissue. There need be no haste in the usual case.

The advantages of local anesthesia are: (1) Uterine atony, delayed placental separation and undue hemorrhage are rarely encountered. (2) There is little risk of narcosis of the baby from anesthesia. If morphine is not administered until one is ready to incise the uterus and extract the fetus, there is no risk at all. (3) The postoperative course of the patient will be considerably smoother. Vomiting, which may tear out peritoneal sutures is seldom seen. Pulmonary complications are rare. Abdominal distention and discomfort are minimal. (4) It is safe in constitutional diseases that contraindicate general anesthesia, as toxemia, cardiac disease and tuberculosis, and may be given with safety to patients with upper respiratory infections.

Technic of Local Anesthesia. A sterile solution of 300 cc. of 0.5 per cent novocain to which 1 cc. of a 1-1000 solution of adrenalin chloride may be added, is prepared. A hypodermic syringe with a fine needle for the initial wheal, two continuous flow syringes with

finger and thumb rings and two long flexible needles are the only special instruments required. A heavy pad for the operating table is a distinct advantage. The anesthetist should take her usual place

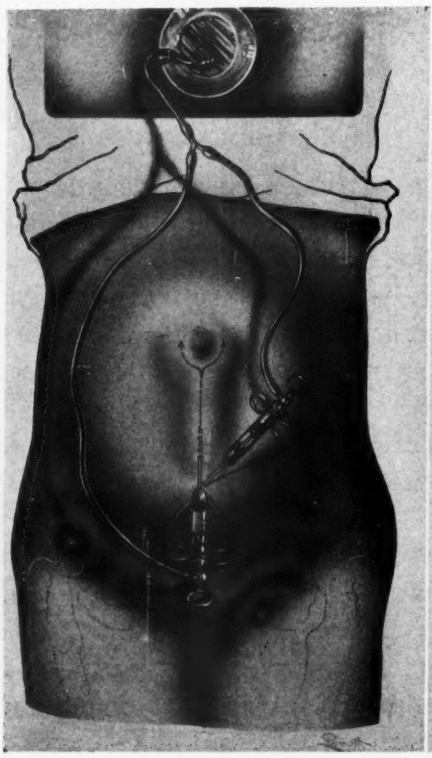


FIG. 1. Local infiltration for cesarean section. Two syringes may be used simultaneously by the surgeon and his first assistant. The basin of novocaine solution and the tubing allow for continuous infiltration. With one syringe the solution of novocaine is injected superiorly; with the other, inferiorly. Note the arrows indicating the fanning-out of the infiltration at the lower third of the mid-abdomen.

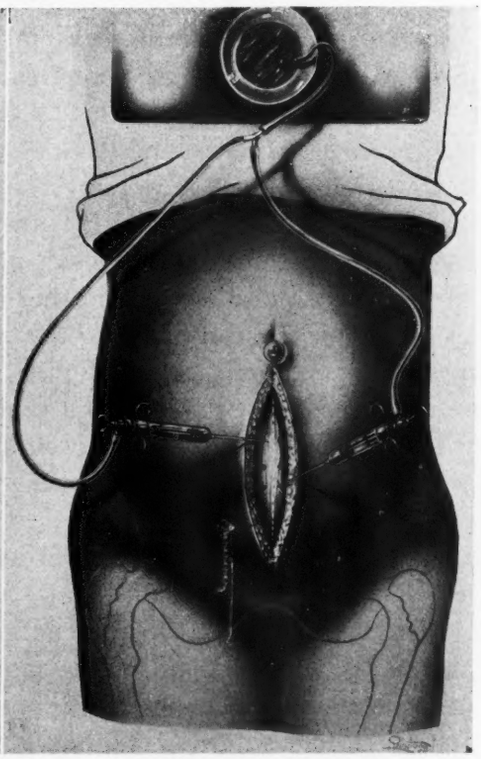


FIG. 2. Local infiltration for cesarean section. The syringes inject the solution of novocaine beneath the anterior sheath of the rectus fascia at the points marked by crosses, half way between the midline and the lateral edges of the wound. Note the fanning out of the infiltration at the lower one-third of the wound.

and may give the patient small sips of water or small pieces of cracked ice during the operation, and engage her in conversation.

The patient's eyes should be lightly covered, because of the glare of the operating room lights, but her ears should not be plugged as some advise, as the operator in whom she has confidence may

wish to reassure her from time to time. She should be informed when the operation has begun.

After a small wheal is raised with a fine hypodermic needle, novocain is injected in large amounts ahead of the advancing long needles, keeping close to the skin, raising a continuous wheal and infiltrating the tissues from the umbilicus to the symphysis in the midline. (Fig. 1.) Simultaneous injection from either side of the table by two operators saves time. Fanwise infiltration of the lower end of the incision in all its depth is of great importance, else necessary retraction will be impossible. Incision may be made with a sharp scalpel only when the operator is convinced that the procedure will be painless. When hemostasis has been carried out, the rectus sheath is filled with a large amount of novocain solution by piercing the aponeurosis at several points on either side of the linea alba. (Fig. 2.) As a rule the posterior rectus sheath and peritoneum will be anesthetized this way. This is better than infiltrating the aponeurosis and peritoneum separately, as the peritoneal infiltration with this method may make it difficult to see or palpate the bladder edge. Fanning out the lower area of infiltration into the aponeurosis is essential. The peritoneum is then opened and the vesico-uterine fold of peritoneum found. Retraction necessary for lower segment cesarean section will be readily possible. Sudden pulling on the retractors is improper since it will almost always cause the patient to have pain, and perhaps lose confidence in the effectiveness of the anesthesia. All movements with the retractors should be slow and deliberate. The visceral peritoneum need not be injected, nor is it necessary to flood it with novocain solution. The uterus may be opened and the baby extracted without pain if the incision is long enough. If difficulty is encountered in lower segment operation, brief inhalation of ethylene or nitrous oxide and oxygen will be necessary. Morphine ¼ gr. may be given shortly before delivery of the baby. Uterine suture and closure of the abdominal incision may be generally carried out without further local anesthesia if the operating time has not been excessive.

INCIDENTAL SURGERY

The addition of other operative procedures to the cesarean operation definitely tends to increase morbidity and mortality. Eisaman and Cook[22] analyzing 1,322 cases of cesarean section with forty deaths were astonished to find that 60 per cent of the women who died had additional operative procedures, while in only eight or 33

per cent of them infection was due to labor. Cesarean section is surgery enough.

Removal of the appendix is indefensible. The residual amniotic fluid and blood are excellent culture media for any bacteria liberated and contaminating the peritoneum. Further, the changing relations and unrest of the cecum during the postpartum period disturbs normal healing of the appendiceal stump. A fatal peritonitis may easily result from an incidental appendectomy under these conditions.

Sterilization alone is never a valid reason for cesarean section. Lazard,[59] who has reported fatalities directly due to tubal sterilization, is convinced that hysterectomy is a safer method of sterilization. Pelvic delivery and sterilization at a later date are much safer procedures. To sterilize a woman simply because she or her husband requests it, and are willing to assume the risk makes a robot of the obstetrician. Since sterilization is not without risk and cannot be undone, it should always be carefully considered. Though it is common practice to offer sterilization at the time of the third cesarean section, we see no good reason for it. Shaw[89] has reported seven cesarean sections on the same patient, and McSweeney[63] recently reported a case of cesarean section for the ninth time.

Myomectomy is accompanied by hemorrhage and the danger of infection and intestinal obstruction. Even breaking up adhesions adds to the risk of operation. When peritoneal bands are encountered during the course of a repeated cesarean, every effort should be made to avoid their extensive separation.

TYPES OF CESAREAN SECTION

It is clear that the obstetrician must, in every case, weigh very carefully the advantages and disadvantages, the dangers and difficulties of the various types of cesarean section which have been devised to minimize the risk of operation in the presence of infection. All types have a place, yet, no matter which operation is selected, the risk largely depends upon the same factors: (1) duration of labor, (2) time of rupture of the membranes, (3) extent of vaginal interference, (4) incidence of actual infection, (5) skill of the operator, and (6) the preparation and facilities for combating complications such as shock and hemorrhage. Even though bacteria may not be present in the uterus at the time of operation, in twenty-four hours or less they are always present in close proximity to an incision which com-

municates with the peritoneal cavity. Infection of the uterus is a fairly consistent finding. Harris and Brown[37] found no sterile cultures at the time of operation when labor had lasted six hours or more.

Reynolds[81] was first to call attention to the dangers of long labor, and Routh[84] later pointed out the significance of interference as well. Holland[43] and later Gordon[31] following their plan of analysis closely, showed conclusively that mortality depends upon the same factors. The following table shows this clearly.

	Cases	Mortality Per Cent
Reynolds (1907)		
Before labor	82	1.2
After a test of labor	158	4.0
Late in labor	49	12.0
Routh (1911)		
Clean cases		
A. Not in labor	245	3.6
B. In labor, membranes intact	224	2.2
Total	469	2.9
Suspicious cases		
C. In labor, membranes ruptured	166	10.8
D. Frequent examinations or attempts at delivery	64	34.3
Total	230	17.3
Holland (1921)		
Contracted pelvis		
A. Not in labor	1202	1.6
B. Early in labor, within six hours	389	1.8
C. Late in labor	220	10.0
D. After attempts at induction	35	14.0
E. After attempts at delivery	107	25.7
Gordon (1928)		
A. Not in labor	343	3.5
B. Early in labor	110	6.4
C. Late in labor	403	7.7
D. After attempts at induction	1	0.0
E. After attempts at delivery	14	13.6

The classical operation is still performed by many who maintain that primary results are no different in either segment, or that no

positive advantages have been shown for the low operation, at least in elective cases. Others select classical section because it is somewhat less difficult and time consuming, or because they believe there is no good reason for the lower segment operation if the patient is to be sterilized. Its advocates contend that the very thickness of the uterine muscle makes approximation easier, protecting the peritoneal cavity from seepage through the wound, and that there is actually but little danger of rupture of the scar when the operation has been properly done in noninfected cases. They argue that there is no more reason for exposure of the bowel than in the low operation, in which extraction is made difficult by an incision naturally shortened by fear of injury to the bladder or the venous reservoir in the broad ligament. Bonney,[7] on the other hand, has said that the chief technical drawback to the classical operation is the fetal trauma associated with the species of version incident to delivery of the breech; and that the fetus usually delivered head first is the principal advantage of the low operation, though forceps' application may not be easy and hemorrhage may be free. It is said, too, that in the classical operation, the placenta is less often disturbed until after extraction of the fetus, and that there is much less danger of hemorrhage when performed for placenta previa. Holmes[45] believes that the actual location of the incision makes no difference at all, the operator being the important factor.

Classical cesarean section with high incision has been relegated to the past. The low classical operation has a limited application and should not be performed at all on women in labor, since the lower segment operation is safer and generally applicable.

Classical Cesarean Section. The abdomen is opened in the midline by an incision extending from about 1 to 2 cm. above the symphysis pubis almost to the umbilicus. Hemostasis should be effective and skin protection careful. Any undue degree of dextroversion or torsion should be noted. The position of the round ligaments will help, and the assistant should correct abnormal positions by either pressure on the right side of the abdomen in the case of dextroversion or by grasping the fundus of the uterus and turning it in the case of dextrotorsion. Failure to recognize these abnormal positions may result in a misplaced incision and undue hemorrhage. The abdominal wound should be surrounded by laparotomy pads and the retractors placed. The bladder reflection at the lower angle of the wound should be visible.

Traction sutures of chromic catgut may be placed at the upper and lower ends of the region to be incised. An ampoule of pituitrin can be given at this time as prophylaxis against hemorrhage. The length of the uterine incision should be sufficient to permit easy extraction of the baby, which should never be dragged through a small incision. Ordinarily about 10 to 15 cm. will suffice. The incision should lie in the contractile portion of the uterus with its lower end a little above the bladder reflection, and occasionally including part of the lower uterine segment. The incision, best begun with a scalpel by cutting the uterine muscle down to, but not into the bag of waters, may then be extended superiorly and inferiorly with a bandage scissors. The use of two fingers in extending the incision may preserve the membranes which are now ruptured. While the amniotic fluid is aspirated, the hand of the operator is introduced into the fundal region of the uterus and one or both feet of the baby are grasped. In extracting the baby, care should be taken to follow the usual technic for breech extraction with especial care of the aftercoming head. Intracranial hemorrhage may occur from the trauma of suprapubic breech extraction just as in pelvic delivery.

Occasionally, the placenta may be encountered under the uterine incision and although this may be suspected when the round ligaments converge toward the pubis or there is a violaceous appearance of the uterine wall, often there is no evidence of its presence. In any case the same technic should be employed with as much speed as is consistent with safety since the hemorrhage is likely to be profuse. If the placenta is reached by the extended uterine incision, the hand may be insinuated between it and the uterus to grasp the feet of the baby, but usually the operator must cut speedily and boldly through it.

When the child has been extracted, the umbilical cord is cut between clamps and the baby handed to the assistant, who waits beside the surgeon with his extended arms covered by several layers of a folded sterile sheet. If local anesthesia has been used, the patient may be given morphine gr. ¼ at this time, or shortly before.

While awaiting separation of the placenta, interrupted No. 2 chromic catgut sutures are placed in the myometrium starting at both angles of the uterine wound. These sutures should reach to but not penetrate the decidua, and are to be left untied until the placenta has been extracted. Traction on the sutures will aid in hemostasis and in placing others. When the placenta has separated, it may be

extracted by gentle steady traction on the cord. If hemorrhage is profuse or separation tardy, the placenta should be extracted without awaiting separation. The sutures already placed are now tied and others inserted to complete the first row. This row should include about the lower two-thirds of the uterine muscle. A second more superficial row of interrupted chromic catgut sutures is now placed with the sutures spaced between those of the low row. These two rows of sutures are generally sufficient for approximating the cut myometrium without gaping. The sutures should be about 1 cm. apart, and although tied sufficiently firmly for hemostasis and accurate coaptation of the edges, they should not be tied too tightly else necrosis with separation of the wound or a weak scar will result. The uterine peritoneum is now closed with a continuous inverting locked stitch, using plain catgut. After gently sponging the pelvic cavity of blood and fluid, it is desirable to bring the omentum down to cover the uterine incision in the hope of preventing later intestinal adhesions.

The abdomen is closed in layers. We prefer to use silk, but whatever the type of suture material, careful attention should be directed to closing the peritoneum; and here the posterior layer of the rectus fascia should be included in the suture, since serious separations of wounds usually begin in a small opening in the peritoneum.

Lower Segment Cesarean Section. Advocates of the lower segment operation contend that immediate results are better, and troublesome postoperative complications rarely follow because peritoneal soiling is confined to the pelvis. They are sure that there is less bleeding since that area is less vascular, and that the incision can be completely and readily covered with peritoneum. If adhesions occur, they involve only the bladder, not the mesentery or intestines, and hence do not give rise to intestinal obstruction. Remote results are better in that menorrhagia and sterility occur much less frequently than after classical cesarean section; and rupture of the scar is much less common and not so likely to be fatal so that future vaginal delivery may be allowed with greater safety.

Marshall's[64] statistics are remarkable. He has reported 246 lower segment operations without a maternal death; in seventy cases in which infection was present or suspected, labor had been surgically induced in fifteen, forceps delivery had been attempted in five and in ten more a variety of other manipulations had been carried out.

It is clear that the relative merits of the upper and lower segment operations must depend upon the accumulation of a large number of statistics in which all the factors of success or failure are carefully weighed. This is not easy, however, for it is not uncommon for hopelessly infected patients to survive either type of operation, or for women not in labor to die of severe infection. In many series classical section carries the burden of risk incident to constitutional disease. On the other hand, the lower segment is reserved by many for infected cases, or at least for those in labor with membranes ruptured, and so may be accompanied by a higher mortality due to preoperative infection or the indication rather than to the operation. As DeLee[15] has pointed out, it would seem clear that if the low operation is selected because of its greater safety in infected or doubtful cases, it should for the same reason be safer in clean cases. No cesarean section is safe if a virulent organism is present or introduced at the time of operation.

Matthews and Acken[65] reviewing 1,066 cesarean sections, show a mortality of 3.9 per cent for classical and 1.9 per cent for the low flap operation. In a careful analysis of this large number of gross figures, they found that the high classical operation "failed in the prevention of sepsis," while there was no fatality from sepsis in the low operation group. There was no mortality in the secondary low flap operation, while the secondary classical sections showed the same rate as the primary; all of the deaths in the repeated cesarean groups followed the high classical operation, five of their eleven deaths being due to intestinal obstruction. After rupture of the membranes the classical mortality rate far exceeded that from the low flap technic, and "the results of the repeat cesarean section furnished considerable evidence for the superiority of the low flap technique." In fact the deaths in lower segment cesarean section were attributed more to the operator than to the operation itself.

This evidence from a fairly large group of obstetricians in a hospital devoted entirely to obstetrics is important. The lower segment operation has grown so steadily in popularity, that many have come to have undue confidence in it, forgetting that the risk in any type of cesarean operation depends upon the same factors. Safety decreases markedly after labor of ten hours with membranes ruptured for six hours.

Operative Field. Reynolds[82] has shown that the isthmus uteri does not participate in the general uterine hypertrophy of pregnancy,

since its elastic and fibrous tissue do not undergo hypertrophy. Stretching and dilatation occur. Frankl[25] has shown that it is this area which stretches in late pregnancy and labor to form the lower uterine segment. With the upper limit at the lower level of firm peritoneal attachment to the corpus, and its lower the supravaginal cervix at the level of the internal os, the lower segment stretches and lengthens as labor progresses, until the entire cervix is taken up with full dilatation. Its peritoneal covering and the venous reservoirs laterally stretch with it, so that late in labor the vesico-uterine fold is difficult to pick up with forceps, and the uterine veins are found stretched, less tortuous and distended.

At term, before labor has begun, the operative area is in the pelvis, its depth depending upon the extent of engagement of the vertex; while, if the head is high or overriding, it is found partly or wholly in the abdomen and readily accessible. The lower uterine segment at term in any case is of sufficient dimensions to allow a crescentic transverse incision to lie wholly within it. There is more difficulty in placing the vertical incision entirely within the lower segment though this is aided by increase in the length of the lower segment as labor continues, or by overriding, the very conditions one is likely to meet in cases of cephalopelvic disproportion after a trial of labor.

Uterine Incision. Incision in the lower segment may be vertical or a modification of the transverse type. It is highly desirable that its entire length be in the stretched noncontractile lower segment, and not extend into the corpus. Marshall[64] states that the transverse incision will fall in the lower segment when the patient is not in labor and until the cervix is half dilated, between the cervix and lower segment or actually in the cervix when dilatation is complete or nearly so, and in the cervix itself if the operation is performed late for obstructed labor, or when a high retraction ring is present. The vertical incision he believes, may be kept in the lower segment when the patient is in labor and the cervix at least half dilated; in obstructed labor it will die in the lower segment and cervix, but in a considerable proportion of all other cases the corpus will be included in the incised area. (Figs. 3 and 4.) Our experience coincides with this.

DeLee[17] and Beck,[5] who are prominently identified with the development of the lower segment operation in this country, prefer the vertical incision. Irving has observed rupture of the scar in four

cases in which the transverse operation had been performed elsewhere. DeLee insists that proximity of the ends of the transverse cut to large vessels invites hemorrhage, thrombosis and embolism.

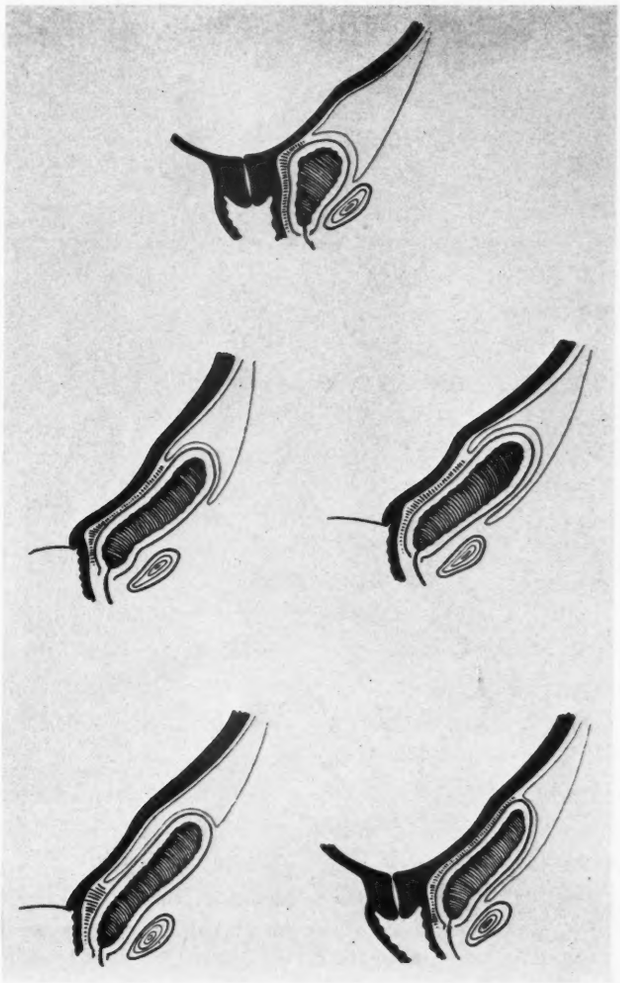


FIG. 3. Relations of bladder, uterus and peritoneum. Upper: Common arrangement before onset of labor. Middle: Arrangements commonly met late in labor. Lower: Arrangements rarely seen. (From Marshall, C. McI. Cesarean Section. P. 44. Baltimore, 1939. The Williams and Wilkins Co.)

He believes, too, that the median scar is stronger, because it is not under strain during healing, and so less likely to rupture in subsequent pregnancy; if suppuration should occur, it is more readily controlled.

The transverse incision grows steadily in popularity because it may be kept wholly within the lower segment or even the cervix,

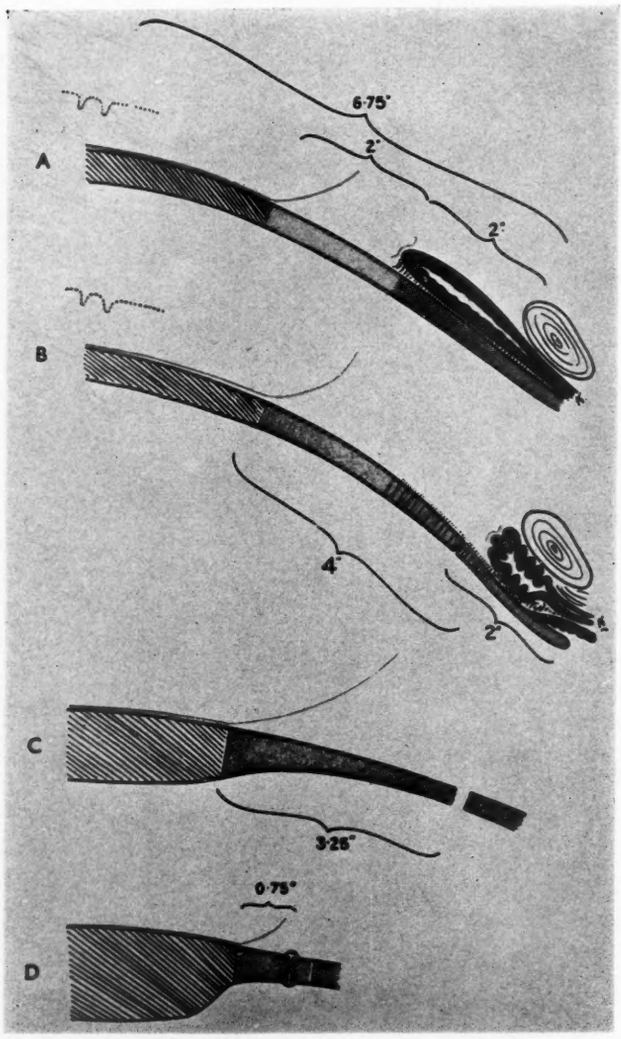


FIG. 4. Measurements from an actual patient operated upon in labor, with the cervix about three-quarters dilated. A, the relationships of the bladder to lower uterine segment and cervix are shown. The junction of the corpus and lower segment was accepted as occurring at the level where the peritoneum obtained firm union with the uterus. The cross-hatched area represents the region between lower segment and cervix. B, bladder mobilized and retracted and the uterus incised. C, after delivery of the child but before the delivery of the placenta. The upper flap of the lower segment *apparently* of considerable length. D, after birth of placenta and corpus strongly contracted. Incision only 0.75 inch below lower border of corpus, therefore, in this case the incision fell in lower segment and *not* in cervix. (From Marshall, C. McI. Cesarean Section. P. 54. Baltimore, 1939. The Williams and Wilkins Co.)

the slight upward curve allowing sufficient room for extraction of the fetus without danger of extension into the venous reservoir. Peritonealization may be carried out with ease and with less dissection of the two peritoneal flaps. The vertical incision is often less satisfactorily covered with peritoneum as the upper flap is more closely attached in the midline and so may be buttonholed, and it may be difficult though necessary to draw the lower flap unduly high on the uterus. Kerr and Hendry[53] proposed the transverse incision, but Phaneuf[74] apparently was the first to stress the importance of placing it well behind the bladder.

According to recent anatomic research it appears that the transverse moderately curved incision is more likely to heal well than the vertical incision. Marshall[64] has well summarized the work of Goerttler[28] who has shown that the essential structure of the wall of the uterus is two intersecting systems of muscle fibers, each the mirror image of the other; the fasiculi of each side arise beneath the peritoneum and run downward and inward to intersect with the opposite side, and end in the endometrium. In the corpus this intersection is at a right angle, in the isthmicocervical segment the angle is obtuse, while in the cervix itself the arrangement is almost circular. Since it appears that the sutured transverse wound should heal under optimum conditions, we prefer the transverse incision.

Technic of the Lower Segment Operation. The abdomen is prepared and opened as in the classical operation. Trendelenburg position is helpful, but inadvisable if infection is suspected. Selecting a point in the vesico-uterine fold, usually about 2 cm. above the bladder reflexion, the peritoneum is picked up with forceps and cut with Mayo scissors. (Fig. 5.) After mobilizing the peritoneum laterally in each direction by a procedure in which the opened scissors is introduced repeatedly and then opened, the uterine peritoneum is cut in a crescentic fashion with the concavity upward. Underlying tissue, generally highly vascular, should be avoided. An upper peritoneal flap is raised by blunt scissors dissection. The lower flap must be fully separated well down into the pelvis so as to place the uterine incision as low as possible in the lower segment or cervix. (Fig. 6.) Occasionally, a well defined band of connective tissue attaching the bladder medially to the uterus must be cut. These flaps should be retracted as widely as possible, and a well rounded retractor used to hold the lower flap and bladder against the symphysis pubis.

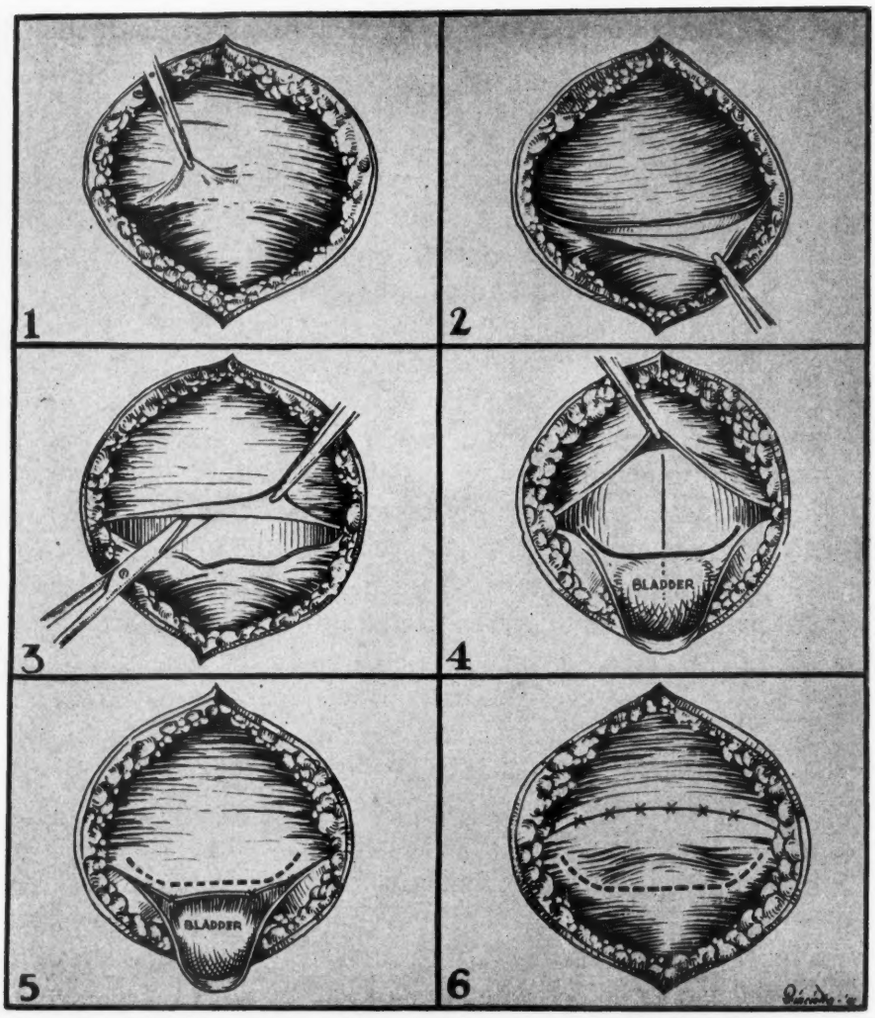


FIG. 5. The lower segment operation. 1, the bladder is seen inferiorly. The forceps picks up the loose peritoneum covering the lower uterine segment at about 2 cm. above the bladder reflection. 2, the peritoneum covering the lower segment of the uterus has been cut transversely by a curved incision, with the concavity directed superiorly. The forceps lifts the edge of the lower flap, which, with the bladder, is dissected from the uterus. 3, the upper flap of peritoneum is dissected from the uterus with the Mayo scissors. 4, the two flaps are retracted to show the lower uterine segment and the position of the uterine incision. The heavy curved transverse line represents the position of the transverse incision recommended. The lighter vertical line represents the position and extent of the vertical incision preferred by some operators. 5, the fetus has been extracted and the uterine incision closed. The upper peritoneal flap has been sutured to the uterus by four interrupted catgut sutures as indicated. The position of the uterine incision is shown by the curved dotted line. 6, the lower bladder peritoneal flap has been brought over the lower segment and sutured superiorly. Note the bladder covering the uterine incision.

A small incision in the uterus is lengthened laterally with bandage scissors, and the fetus extracted. Pituitrin or ergonovine is best given when this has been done. The placenta is delivered by pressure on

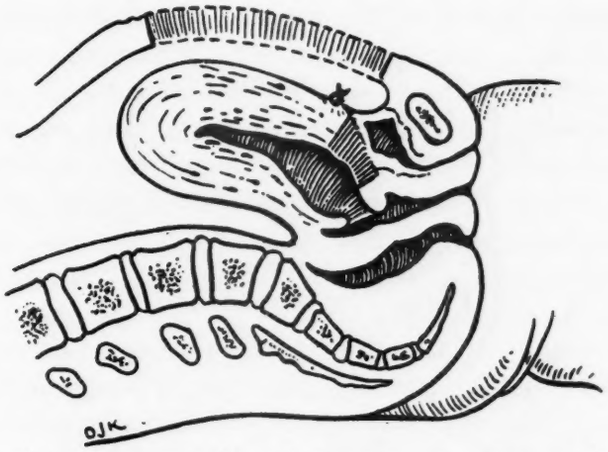


FIG. 6. The suture shows final position of uterine wound after closure and restitution of uterovesical peritoneum and bladder, when care has not been taken to make the transverse uterine incision sufficiently low. (From Marshall, C. McI. Cesarean Section. P. 102. Baltimore, 1937. The Williams and Wilkins Co.)

the fundus through the abdominal wall and steady traction on the cord. Great care should be exercised to see that the membranes are completely removed.

The uterine wound is then closed in two layers, using No. 1 chromicised catgut interrupted sutures about 1 cm. apart for the myometrium, and the same material as a running suture for coaptation of the segmental fascia. The end sutures should be left long to be used as tractors, as the uterine wound tends to sink into the pelvis with closure. The upper edge is often much thicker than the lower, yet careful approximation is not difficult if sutures are placed properly. The lower the incision, the less this becomes necessary. No harm comes of inclusion of decidua in the first layer of sutures. Hot laparotomy pad pressure assists final hemostasis. The upper peritoneal flap is then fastened below the incision by a few fine plain gut sutures, and the bladder flap drawn up and sewed down in a similar fashion. The incision is now covered by two layers of peritoneum, or if low enough, by a layer of peritoneum and the base of the bladder. The operation which has been simplified by raising the

lower flap alone does not provide the protection of double peritonealization. The abdomen is then closed. Some advise drainage.

Extraction of the fetus and placenta often present special problems. When the occiput is posterior it may be rotated anteriorly by placing a finger in the baby's mouth, and then extracting with forceps, or by using one blade as a vectis. Forceps should be ready, for even in anterior positions simpler methods may fail. Rarely fixation of the presenting part in the pelvis may make it necessary for an assistant to dislodge the head by inserting a finger in the rectum, or even by vaginal manipulation. We have never had to do this, however. When a large part of the fetal head lies below the level of the incision it is better to lift it by pressure applied through the uterine wall than by the hand in the uterus.

Manual removal of the placenta should not be practised unless hemorrhage arises from partial separation, or separation is too long delayed. Kerr[52] removes the placenta, in cases advanced in labor, by dropping the cord clamp into the vagina, and having an assistant draw it out, and states that it will almost certainly come away easily if sterile water or salt solution is injected into its vessels. He believes that every device should be used to avoid abdominal removal of the placenta with peritoneal contact of infected tags of membrane from the lower segment or vagina. Disinfection of the uterine wound or the entire lower segment has been suggested.

Peritoneal Exclusion Cesarean Section. Cesarean section may be performed either in the corpus or lower segment of the uterus after approximation of the parietal to the visceral peritoneum, thus forming a space outside the general peritoneal cavity through which delivery may be effected. The operation is performed by some in cases that need cesarean section when long labor, repeated examinations or attempts at delivery have resulted in potential or actual intrauterine infection. It is intended to protect the general peritoneal cavity against contamination from the spill of infected uterine contents at the time of operation and from leakage subsequently.

The operation resembles in its indication the lower segment operation with extraperitoneal closure and the true extraperitoneal operation. It will protect the infected case against peritonitis better than the former but not as well as the latter operation. The exclusion operation has not gained nor apparently merited the popularity of the lower segment operation. The simplest form of the exclusion operation with the uterine incision low in the corpus, should find its

greatest application in instances in which the operator is unable to do a more technically difficult operation. The technic of the operation follows:

Veit-Fromme-Hirst.[41] The abdomen is opened through a midline incision beginning just above the pubis and extending to a few centimeters of the umbilicus. The visceral peritoneum covering the lower uterine segment is incised to the bladder and both are separated. The edges of the parietal and visceral layers of peritoneum are united by interrupted sutures of fine catgut. The uterus is then incised longitudinally in the lower segment and the child and placenta delivered. The uterus is closed in the usual fashion. Continuous fine chromic catgut may be used to reinforce the union of the two layers of peritoneum. Drainage is included when indicated. This operation may be better if performed in the lower segment through a transverse incision.

Irving's Modification. Irving[47] noted that the thin layers of parietal and uterine peritoneum often tore during the extraction of the fetus, so that the operation ceased to be extraperitoneal. He proposed a modification that is the simplest of the exclusion operations. The abdominal incision is the same as for the classical cesarean except that it is somewhat higher, its upper angle extending about an inch above the umbilicus. No walling off pads are used. The conjoined layer of peritoneum and fascia is sewed first at the upper and lower angles of the wound to the anterior surface of the uterus with interrupted mattress sutures of No. 1 chromic catgut. Each stitch penetrates the conjoined layer of fascia and peritoneum, takes a bite in the uterine peritoneum and muscularis, and emerges again through the conjoined layer. Similar stitches are inserted on each side, parallel to the edge of the wound and about a quarter of an inch outside it, until there is a firm union between the uterus and the abdominal wall and an oval area on the anterior surface is excluded from the peritoneal cavity. The uterus is incised vertically in this space, and the fetus, placenta and membranes removed. If there is any considerable bleeding, a gauze pack is inserted, to be removed twelve hours later through the vagina. The uterus is sutured in the classical manner. A cigarette drain to the uterus is placed in the lower angle of the wound, and the conjoined peritoneal and fascial layers are united in the midline by interrupted catgut sutures.

This operation may result in high fixation of the uterus with resultant sterility, and later operation may become necessary. Since

a transverse incision in the lower segment is preferable, E. F. Smith[91] proposes such a technic through a Pfannenstiel incision. Fixation of the lower segment to the abdominal wall will not follow this operation, which is recommended for women with potential infection.

Extraperitoneal Cesarean Section. Structural changes in the lower abdomen and pelvis during pregnancy and especially labor make it possible to expose a sufficient area of the lower uterine segment to perform cesarean section extraperitoneally. During pregnancy the bladder rises higher with increase in the length of the lower uterine segment and loosening of the endopelvic fascia. The anterior cul-de-sac is often obliterated. (Fig. 3.)

It may be necessary to perform cesarean section when probable or actual intrauterine infection is present. A true extraperitoneal operation should decrease the risk of postoperative peritonitis and at the same time conserve the uterus. There can be little question of the advantages of a technic that would enable the obstetric surgeon to perform a true extraperitoneal operation when it is indicated. The modern operation developed by Latzko[57] has been recently modified by Waters.[96] The Latzko procedure is based on lateral displacement of the bladder and peritoneal reflextion, and the Waters on direct supravesical approach. Descriptions of the technic follow:

Latzko Operation. The bladder is catheterized and distended by the instillation of 200 cc. of boric acid solution. The catheter is left *in situ*, but clamped and attached in such a way that the bladder may be emptied or refilled when necessary. High Trendelenburg position is employed. A midline abdominal incision extends from the symphysis pubis to the superior limit of the distended bladder. Care should be taken with incision of the fascia that the bladder and peritoneum are not included. Separation of the bladder should begin on the left side since the common dextroversion and dextrotorsion of the uterus make this part of the bladder more readily accessible.

The upper left portion of the bladder is freed and separated from the anterior uterine wall and the left rectus muscle retracted. Further separation of the bladder is done carefully while the bladder is retracted to the right. The loose connective tissue of the endopelvic fascia holding the bladder to the fascia covering the lower uterine segment is separated. Similar dissection of the tissue which attaches the vesico-uterine peritoneal fold to the fascia of the lower uterine segment is made, thus enabling this fold to be displaced superiorly. Emptying of the bladder and retraction to the right will expose a

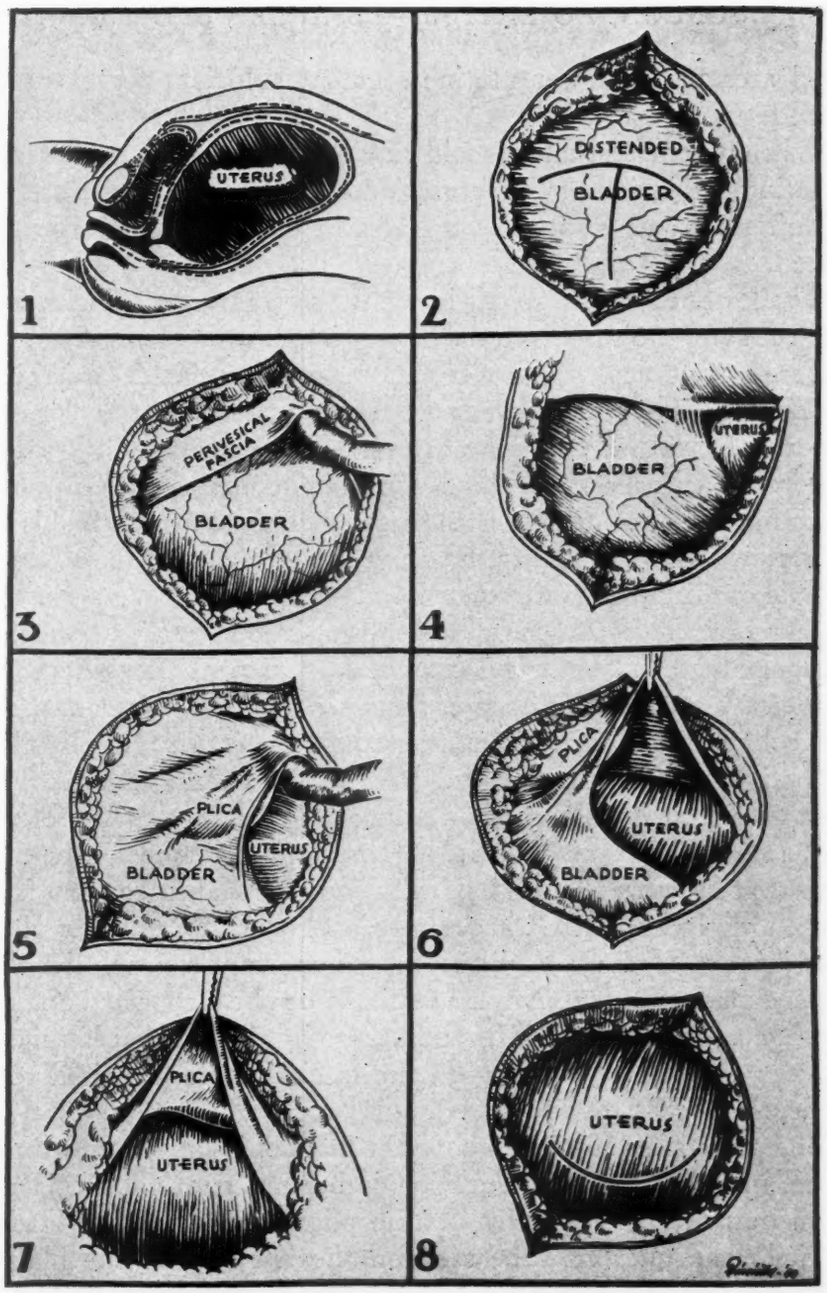


FIG. 7. The extraperitoneal cesarean section (Waters). 1, a sagittal section of the abdomen showing the relationships of the fascia and folds of the peritoneum. 2, the T-shaped incision in the fascia covering the bladder is indicated. 3, the finger is separating the perivesical fascia from the underlying muscle of the bladder. 4, the relationship of the uterus, bladder and lower edge of the plica of peritoneum are represented. The figure shows a few fine filaments of connective tissue between bladder and fascia. 5, 6, and 7, further steps in the separation with final exposure of the lower uterine segment. 8, the position of the lower uterine incision.

broad area of the lower uterine segment sufficient for extraction of the fetus.

When it appears that this fold may be torn either in its dissection or during extraction of the fetus, Aldrich[1] incises it deliberately on the left side, and resutures its edges before the uterine cavity is opened.

The lower uterine segment is opened by an incision that extends from the symphysis pubis to the peritoneal reflextion, and the child is delivered by forceps application and extraction. Pituitrin is given, and after delivery of the placenta the uterine incision is closed by interrupted chromic catgut sutures. A second layer of sutures reinforces the closure. The bladder is again distended so that possible injury may be detected and then emptied. The peritoneal fold is now replaced with a few fine catgut sutures, and the abdomen closed with a pelvic drain in the lower angle of the wound.

Waters Operation. The abdomen is opened by a left paramedian incision extending from the pubis to 2 cm. below the umbilicus. The bladder is distended with 200 cc. or more of sterile solution, preferably colored with a little methylene blue. The transversalis fascia and perivesical fascia are incised down to the bladder muscularis for about 2 to 3 cm. at about two-thirds of the distance to the bladder fundus. The vesical vessels are seen lying upon it. A blunt instrument is inserted between the muscularis and perivesical fascia, the fascia freed, and then incised transversely over the top and left of the bladder in a "T" fashion. (Fig. 7.) It is important to reach the plane between bladder and perivesical fascia. It can be recognized not only by the blood vessels at this level, but also by the bulge or herniation of the bladder that occurs when the fascia has been incised to its full depth.

The parietal peritoneum above the bladder is carried up with the fascia, and the bladder separation is begun. The bladder is now drawn downward, the vesico-uterine plica found and the bladder emptied. The plica may be seen on the left side of the bladder superiorly. The areolar tissue in this area is easily separated by holding the bladder down and separating by blunt dissection. When the plica is seen the finger may be insinuated beneath it, and dissection from this point more readily carried out. When the finger is in position the following relationships may be noted. Below the finger is the perivesical fascia at the back of the bladder, behind is the peri-uterine segmental fascia and the uterus, and on the finger is the plica

which represents the lowest level of the peritoneal fold of the utero-vesical pouch or anterior cul-de-sac. It resembles a hernial sac and its integrity must be maintained if the operation is to be truly extra-peritoneal. The vesico-uterine plica with its underlying fascia must be freed from the posterior surface of the bladder so that the bladder can be completely retracted. The perivesical fascia must again be cut to accomplish this but this time at the junction of uterus and bladder. In separating the plica great care must be exercised to include the underlying fascia as well, else perforation of the peritoneum is likely to occur. The success of the Waters operation depends upon treating the peritoneum and its underlying fascia as a single structure that can be separated easily. Attempts to free the peritoneum alone will almost always result in tearing. When the bladder has been well retracted the lower uterine segment is exposed and may be incised in the transverse crescentic manner described under the lower segment operation. Delivery of the child and closure of the uterine incision are carried out as described previously. The bladder should be refilled to discover the results of any undue trauma and the retrovesical space drained with rubber tissue.

Cesarean Hysterectomy. Cesarean section followed by supra-vaginal or total hysterectomy is sometimes called radical cesarean or Porro operation. When Porro[77] removed the uterus, however, he effected hemostasis with Cintrat's serre-noued, a wire snare which tightly encircled the uterus at the level of the internal os. The wire loop was tightly drawn, tightened again on the third postoperative day and removed on the fifth. Since it has been so often stated that Porro used an elastic ligature for this purpose, an actual photograph of the instrument he used in his classic procedure is reproduced. (Fig. 8.) The modern cesarean hysterectomy is not a Porro operation.

Cesarean hysterectomy finds its greatest application in cases of severe uterine infection, when suprapubic delivery is necessary. Extraperitoneal cesarean section will not afford the same measure of protection. Hysterectomy after cesarean section may also be indicated for uterine myomas, separation of the placenta, placenta accreta, rupture of the uterus, cancer of the cervix and uncontrollable postpartum hemorrhage.

Technic. The abdomen is opened in the midline from the pubis almost to the umbilicus. If infection is present, laparotomy pads should be carefully placed so as to reduce peritoneal soiling to a minimum. The uterus is then incised, as in the classical operation,

fetus and placenta extracted, and the uterine incision rapidly closed by three or four deep hemostatic sutures. The broad ligaments are then divided between clamps close to the uterus taking care to

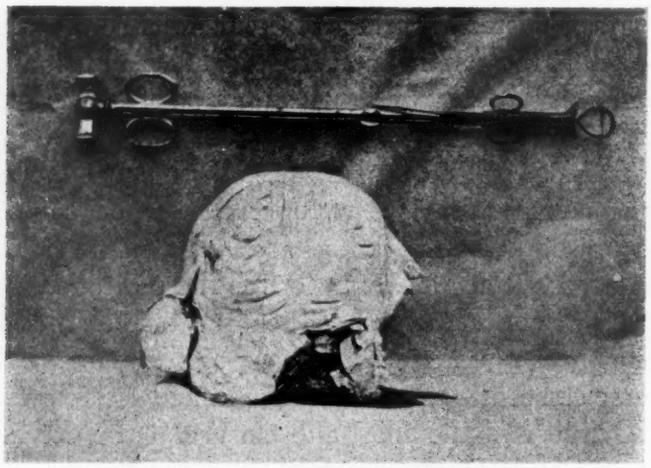


FIG. 8. Wire snare used by Edordo Porro in his first cesarean hysterectomy, May 21, 1876. The left tube and ovary were included in the loop. Note the oblique incision in the uterus.

include the tubes and round and ovarian ligaments. An anterior peritoneal flap is raised by incising the vesico-uterine fold. The uterine vessels are secured by Ochsner clamps pointing inward and downward to the cervix at about the level of the internal os. The cervix is now cut through transversely. Ligation of ovarian vessels should be carried out without opening the broad ligament which may bleed freely. Ligation of uterine vessels is made safe by traction on the cervix and suturing them to it. The cervix is now covered, without entering the canal, by approximating its fascial covering with chromic sutures. There will be no difficulty finding ample peritoneum to cover it smoothly. The broad ligament is now closed, tacking the round ligaments to the cervix. The abdomen is closed without drainage.

Various modifications of this technic may be found desirable. The unopened uterus may be eventrated, the abdominal wall partially closed behind it, the peritoneal cavity protected by large pads and hysterectomy performed. If the fetus is alive, this must be accomplished quickly or it will perish. Hysterectomy may be total, or subtotal, particularly in the case of rupture of the uterus involving the cervix, and in this event, the vaginal vault should be carefully

closed, using interrupted chromic sutures. If removal of the uterus should become necessary for hemorrhage in the course of the transverse lower segment operation, hysterectomy is best performed by continuing the incision circularly around the lower segment.

Cesarean Section with Exteriorization of the Uterus. The treatment of frankly infected cases has long been a serious problem. In 1908, Selheim[88] sutured the open uterus to the abdominal incision, thus forming a utero-abdominal fistula for drainage until the uterus was later freed and replaced in the pelvis. In 1924, Portes[79] first performed exteriorization of the uterus, though this procedure had previously been proposed by Gottschalk.[35] The intent was to remove the uterus and adnexa from the abdominal cavity until the danger of peritonitis had passed.

Portes Operation. The operation is rarely performed, but may have a definite place in operative obstetrics. It is indicated in the grossly infected case in which abdominal delivery must be done after repeated attempts at vaginal delivery have failed. It resembles cesarean section followed by hysterectomy in its indication, but has the advantage in that it is less time consuming and traumatic to the patient, and is the better procedure when the patient is a poor surgical risk because of shock. It has also the advantage of conservation of the uterus, and cases in which subsequent pregnancies have been carried to term have been recorded.[73] In the event infection of the uterus is so extensive that sepsis seems uncontrollable, hysterectomy may be performed extra-abdominally when the patient has recovered from shock.

Technic. The operation is performed in two stages:

First stage: The abdomen is opened by a long incision beginning a little above the pubis and extending well up into the upper abdomen. The uterus is delivered and covered by moist laparotomy pads or towels. The abdominal wall is closed behind the uterus down to the cervix. Before the uterine corpus is incised, the area about the cervix should be carefully filled with dry laparotomy pads to prevent spill of the usually grossly infected uterine contents into the general peritoneal cavity. After extraction of the fetus and placenta the uterus is sutured in two layers as in the classical section, and then covered by moist dressings. The uterine incision may burst open, or it may become necessary to remove the sutures.

Second stage: After about five or six weeks, when involution is largely completed and the uterus clean and its scar well healed, the

abdominal incision is partially reopened, the uterus freed from its adhesions and dropped back into the pelvis. Drainage is indicated.

POSTOPERATIVE CARE

Application of the dressing after completion of the operation should receive careful attention. Whatever the method, the wound must be protected against the possible strain of coughing or vomiting. The adhesive straps should reach sufficiently posteriorly so that moderate traction can be used in placing them. The superior strap should be gently applied as to allow for postoperative distention, and should not reach above the level of the umbilicus, so that a relaxed fundus may be massaged if necessary. A good plan is to place the first straps obliquely, the lower ends extending below the iliac crests to the posterolateral regions of the upper thighs and the upper ends to the lower ribs posteriorly on the opposite sides. The transverse straps may then be placed. Before any adhesive tape is applied it is advisable to cover the dressings with waxed paper so as to allow for simple mesial cutting of the tape and ready exposure of the wound when it is necessary to remove the skin clips or sutures on the seventh day. If perforations are placed in the edges of the cut adhesive tape dressing it may then be laced together, thus making it unnecessary to remove the dressing only to apply another, a procedure which often irritates the skin and causes distress.

For the first eight hours after the patient has been returned to bed she should lie flat and then be placed in moderate Fowler position. If there is any tendency to bleeding, ergonovine should be given every four hours for the first day. This medication is used routinely by some. Pain should be relieved by morphine, one-sixth to one-quarter of a grain every four hours for the first day, and by codeine in one grain doses later. Phenobarbital will be just as useful in some cases.

It is generally necessary, even when local anesthesia has been used, to administer fluids parenterally during the first day. Two thousand cc. of normal saline may be given subcutaneously and one thousand cc. of a dextrose solution intravenously. The total volume of fluids for the first day need not exceed three thousand cc. Liquid nourishment may be given on the second day, a soft diet on the third and then a gradual increase to a general diet. The bowels should be opened on the fourth day by an enema followed by daily use of mineral oil, or a gentle laxative or enema when necessary.

The care of the bladder is important, since minor bladder disturbances are common. As noted under preoperative care, if the bladder is empty during the operative procedure it is less likely to be traumatized and exhibit postoperative atony. In any case there is no need for an indwelling catheter postoperatively. If the patient is unable to void spontaneously, she should be catheterized under strict aseptic precautions every six or eight hours to avoid an overdistended bladder. When she has begun to void, the residual urine should be estimated, and when less than one ounce catheterizations may be stopped.

The patient may be allowed out of bed on the eleventh or twelfth day, and to go home on the thirteenth or fourteenth postoperative day. Before discharge, the adhesive tape dressing may be entirely removed and the wound inspected. Following removal of the skin clips or sutures on the seventh day, small transverse adhesive straps may be placed directly across the middle three-fourths of the wound to prevent separation of the skin edges with the later production of a thick scar. A light dressing may be applied or none at all if the wound is clean and the patient has a good abdominal support of some sort.

Cardiac patients should be kept in bed at least two weeks, and examined by a cardiologist before they are allowed out of bed. Then, if warranted, they may remain up for short periods each day, taking on their usual duties slowly for a few months. Nursing, except in mild cases, should not be permitted.

The necessary instructions for the care of the patient at home should be given at this time. The care of the breasts is the same as for any puerperal patient. Finally, adequate postpartum examinations should be made at later dates to determine the ultimate healing of the wound and the involution of the pelvic organs.

COMPLICATIONS AND SEQUELAE

Hemorrhage during the course of the operation should be managed by kneading or massaging the uterus, pushing or pulling it higher into the abdominal cavity and making certain that no placental fragment or piece of membrane has been left adherent to its wall. Pituitrin may be injected into the uterus, or intramuscularly into the deltoid, but not into a vein. Pastore and Stander[72] have reported a high incidence of protein reaction, with one death, following intravenous use of pituitrin. Ergonovine is safe and more

reliable. The uterine cavity may be packed temporarily until the uterus contracts firmly. In placenta previa it may exceptionally be advisable to ligate a vessel in the placental bed, or a twelve-hour uterine pack may be occasionally necessary.

Postoperative shock is largely due to hemorrhage, but minimal bleeding may precipitate it if the patient has been long in labor, or if the anesthetic has been poorly selected or unduly prolonged. Blood plasma or serum should be administered. Intravenous dextrose is valuable only when shock is minimal; later on it is harmful. The indication is to restore blood volume. Cardiac stimulants and adrenalin are contraindicated and harmful. Morphine should be given. Oxygen is indicated while carbogen is not. Body warmth should be conserved, but care should be taken that blood volume is not further depleted by dehydration due to sweating. Transfusion may be indicated later.

Infection of the uterine wound is a serious complication and more commonly follows an operation performed in the presence of actual or potential uterine infection. When it occurs, the location of the uterine incision largely determines the development of peritonitis. The classical cesarean section offers little protection, the lower segment operation affords fair protection and the true extraperitoneal operation in most instances provides the best assurance of safety. The safety of the lower segment operation that includes a transverse incision low in the cervix should equal that of the true extraperitoneal operation, if it is agreed that an infected incision and not anmiotic spill is the important cause for peritonitis.

Local uterine inflammation is not uncommon, and involution is often delayed. Occasionally, it is possible to recognize the formation of a uterine or extrauterine abscess clinically, though the common symptoms of fever, rapid pulse and a tender uterus do not necessarily indicate this complication. Abdominal drainage over Poupart's ligament has been successfully performed in such cases.

Peritonitis is the common fatal complication. It may result from drainage of an infected uterine wound into the abdomen, or lymphatic spread, vascular extension, direct continuity and tubal extension from infected decidua. Lochiastasis will predispose to extension of intrauterine infection by any route and should be watched for and prevented. Vaginal swab cultures or routine intrauterine cultures taken at the time of operation will be the basis for

proper selection of sulfonamide therapy.[33,34,83] No other therapy is specific.

Simple wound infection may occur or actual wound disruption, which may be associated with intestinal obstruction. High temperature and saturation of the abdominal dressings with serous fluid are early clinical signs. Even though skin union is apparently good, on inspection and palpation of the wound the diagnosis is not difficult. Careful reduction of protruding omentum or gut, with their retention by a strip of vaselined gauze and firm adhesive strapping will give better results than resuture.

Pulmonary collapse may occur postoperatively with subsequent atelectasis. Phlebitis, pulmonary embolism and infarct are usually closely related complications of the late puerperium and are always due to sepsis. Morphine is valuable. Though transfusion may appear to be indicated—and it often is—due caution must be exercised for it is not without danger.

The bladder or ureter may be injured during operation. When urinary tract infections complicate the puerperium, it is important to remember that clinical cure is not certain until urine cultures become negative.

Incisional and umbilical hernia and rupture of the uterine scar in subsequent pregnancy are late sequelae. Montgomery[68] believes that hernia is a more common sequel of cesarean section than of any other form of lower abdominal operation. Avoidance of postanesthetic vomiting, careful suture of the abdominal wall and properly applied adhesive dressings are important factors in prevention.

Peritoneal adhesions are a common result of the classical operation, and symptoms of chronic intestinal obstruction may recur from time to time.

It is not possible at present to determine the part played by cesarean section in later sterility or abortion.

PROGNOSIS

It is impossible to discuss the actual mortality of cesarean section in the United States in any but general terms. It is probably at least 10 per cent and possibly approaches 15 per cent. Reports from well conducted clinics and individual operators as a rule show better results than those of local comprehensive surveys. On the whole the risk of operation has been lessened, yet Holland[43] as early as 1921

reported a mortality of but 4 per cent in 4,197 operations in thirty-seven British hospitals.

King[56] in a comparison of two cesarean section surveys in New Orleans found a maternal mortality of 16 per cent in 300 operations performed from 1921 to 1926 and 5.9 per cent in 1,108 operations from 1927 to 1936. Quigley,[80] in 1939, has reported a mortality of 2.9 per cent in 937 cesarean sections for a ten-year period in Rochester and Monroe County, New York. DeNormandie,[19] reporting a total of 2,106 abdominal deliveries in Massachusetts in 1937 found the mortality rate but 3.1 per cent. Irving[46] found a gross death rate of 5.8 per cent in all types of cesarean section in 11,491 cases compiled from seventeen American authors. Arnold[3] comparing all available reports published since Plass'[75] compilation in 1931, quotes thirty American authors reporting 15,768 cesarean sections with a maternal mortality of 4.69 per cent.

Lynch,[62] in 1937, collected a large series of 12,055 cesarean operations with a mortality of 4.1 per cent. Bland[6] discussing this paper said: "In an exhaustive analysis of the world's literature for the past two decades, I found a series of 65 papers devoted to a general survey of postoperative cesarean section mortality. In this series there were recorded 1,843,356 deliveries. Of this number 19,480 (1.5 per cent) were effected by the abdominal route and 1269 (6.5 per cent) of the patients died. In some of the papers published in this country the maternal death rate was unbelievably high. For example in the series reported by Bickel of Indiana it was 17.3 per cent. In the survey conducted in the City of New Orleans it was 16.1 per cent. Magnus Tate in his study reported a rate of 16 per cent. In a survey made in the State of Texas, it was 14.4 per cent. In Europe it runs a deadly parallel and ranges between 6 and 7 per cent. Loss of life is by no means negligible. In the series of 1,843,356 deliveries with 19,480 sections recorded in this country and abroad there were 913 dead babies or a fetal mortality of 4.4 per cent."

In Arnold's tabulation of national cesarean statistics from twenty-five American authors for 1931 to 1939, the fetal mortality was 8.8 per cent in 9,884 cases, ranging from 2 per cent in a series of 347 cases to 17 per cent in 329 cases. Daily,[14] however, has reported 1,000 consecutive cesarean sections performed by fifty operators with but eight deaths, or 0.8 per cent.

If it is admitted that growing emphasis upon the value of the baby is partly responsible for the increasing incidence of cesarean

section, a fetal mortality at least twice as high as the general fetal rate deserves consideration. Fetal and neonatal death are due chiefly to atelectasis, prematurity and intracranial hemorrhage. The indications for cesarean section and complications of pregnancy would appear to be important factors.

Miller[67] in an excellent study of the effect of methods of delivery particularly cesarean section on fetal and neonatal mortality, points out that cesarean section surveys have paid scant attention to the infant, reporting only on its mortality. He believes that the post-cesarean section mortality in premature infants depends almost entirely on the birth weight irrespective of complications of pregnancy. The high incidence of prematurity associated with placenta previa, separation of the placenta and toxemias of pregnancy seriously affects the figures. It is equally obvious that cesarean section simply as a method of delivery should not be associated with higher fetal mortality than spontaneous delivery or low forceps. The opposite should be the case. For practical purposes, fetal mortality will depend upon the birth weight, in the case of cesarean section performed before term, and upon the character and duration of labor at full term.

CONCLUSION

Cesarean section is probably the most valuable therapeutic procedure in the armamentarium of the obstetrician. Its proper use, however, represents a real problem. The continuing increase in its incidence is largely due to a broadening of the indications for operation. The importance of contraindications to operation, however, is not generally appreciated. The increase in the incidence is due in part to the dictum "once a cesarean always a cesarean." There is steadily accumulating evidence that this dictum should be modified, since with more common use of the lower segment operation the risk of rupture of the uterine scar is considerably lessened. In any case, the type of previous section, evidence of previous postoperative morbidity and the occurrence of previous infravaginal delivery are important factors that should be given consideration.

The contraindications to the operation should be well known. While the risk is but one-half of one per cent under ideal elective conditions it rapidly rises with potential or actual uterine infection. Every effort should be made to perform cesarean section early in labor or before labor has begun. A proper trial or test of labor in

borderline cephalopelvic disproportion, and more general knowledge of the value of *x*-ray study should do much toward lowering the incidence and risk of operation, yet roentgenographic prediction alone, however expert, will not satisfy the obstetrician. His experience is the greatest single factor in the evaluation of indications. Not every abdominal surgeon is qualified to do a cesarean section and those who are ignorant of the risk or unable to weigh its indications or contraindications should not perform the operation regardless of their technical skill.

Selection of the type of cesarean section to be performed should be made with the greatest care. The advantages of the lower segment operation are now so well accepted that the classical operation is rapidly losing favor and today has but limited application. The most recent and important contribution to the technic of the lower segment operation is concerned with placing a transverse incision low in the uterus, behind the bladder and in the cervix if possible. Such an incision in a potentially infected uterus should afford great safety in that an infected wound can find easy vaginal drainage. This operation may be equal to the true extraperitoneal operation in its safety, for there is reason to believe that the amniotic spill is not nearly so important as the remaining infected uterus as a cause of fatal sepsis. For this reason, when the uterus is actually infected and cesarean section is indicated, any operation which leaves the uterus behind is dangerous, and hysterectomy following the section is the procedure of choice.

Cesarean section occupies a prominent place in preventable maternal mortality. Much can be done to reduce the danger of operation. Incidental surgery during the course of the operation is contraindicated. The choice of anesthesia is of great importance. There is considerable evidence to show that spinal anesthesia is especially dangerous for the obstetric patient, and that local anesthesia is safest. Any operator capable of performing cesarean section should be able to give adequate local anesthesia in the usual case. Hemorrhage and shock are common causes for death that can be largely controlled. In every case of cesarean section provision should be made for adequate replacement of blood loss. Blood plasma should always be immediately available in the event that compatible whole blood cannot be quickly secured.

Worldwide statistics clearly show that the morbidity and mortality of cesarean section are higher than for any other pelvic

operation. It is clear that proper appreciation of all the factors concerned with the solution of this important problem will lessen the risk of operation.

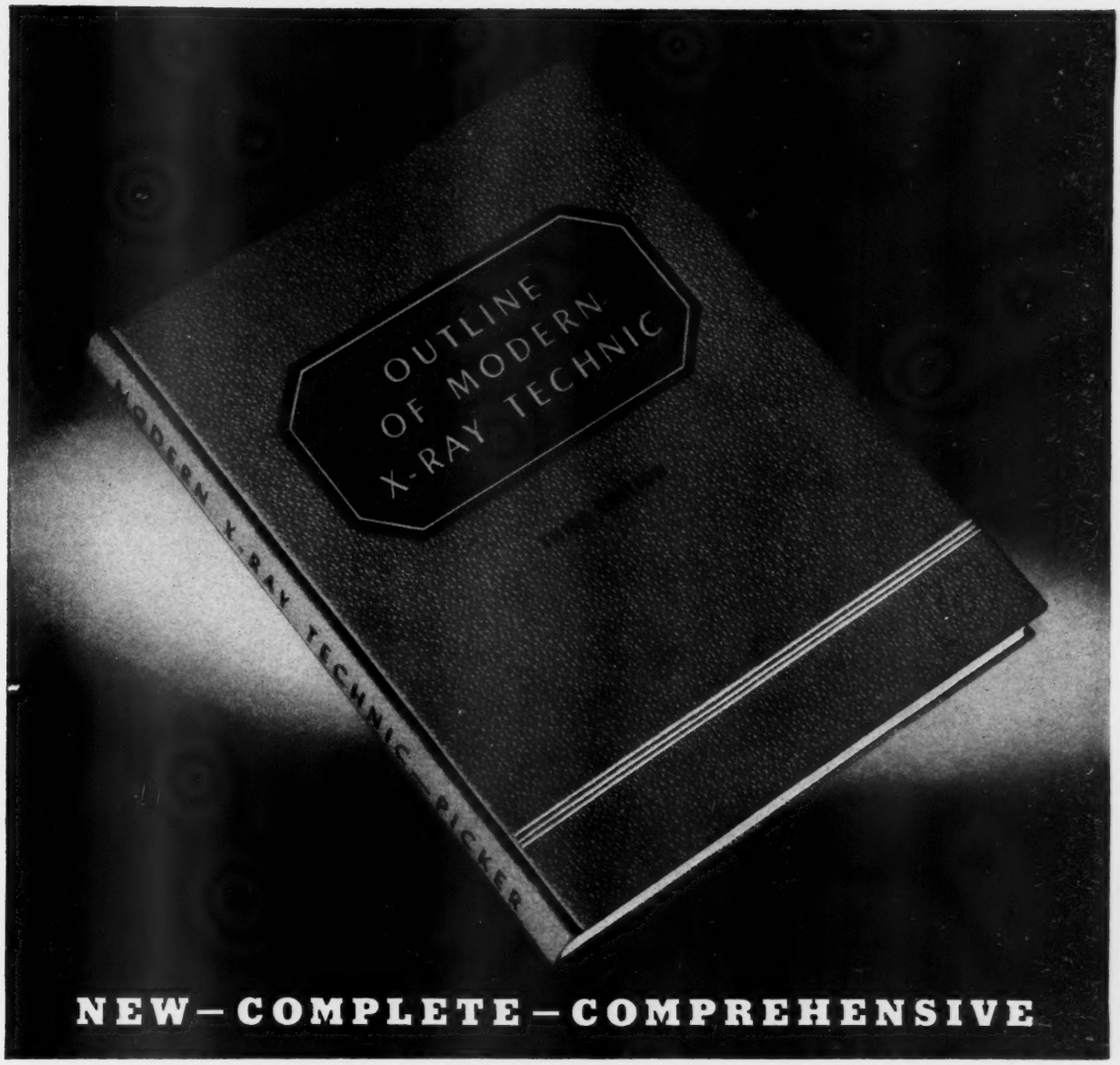
REFERENCES

1. Aldrich, A. H. Extraperitoneal Latzko cesarean section. *Am. J. Obst. & Gynec.*, 34: 789, 1937.
2. Alsever, J. B. and Ainslie, R. B. A new method for the preparation of dilute blood plasma and the operation of a complete transfusion service. *New York State J. Med.*, 41: 126, 1941.
3. Arnold, L. E. Cesarean section; a comparative study. *Am. J. Obst. & Gynec.*, 39: 802, 1940.
4. Babcock, W. W. (Foreword), Maxon, L. H. Spinal Anesthesia, Philadelphia, 1938. J. B. Lippincott Co.
5. Beck, A. C. The two-flap low incision cesarean section. *Surg., Gynec. & Obst.*, 33: 290, 1921.
6. Bland, P. B. (Discussion), Lynch, F. W. More conservatism in cesarean section. *Surg., Gynec. & Obst.*, 64: 338, 1937.
7. Bonney, V. Lower segment cesarean section. *Lancet*, 1: 796, 1933.
8. Brodin, P. and St. Grion, F. Plasma transfusion. *J. A. M. A.*, 113: 2072, 1940.
9. Brown, T. K. Bacteriology of the uterus at cesarean section. *Am. J. Obst. & Gynec.*, 38: 969, 1939.
10. Caldwell, W. E., Moloy, H. E. and D'Esopo, D. A. More recent conceptions of pelvic architecture. *Am. J. Obst. & Gynec.*, 40: 558, 1940.
11. Cosgrove, S. A., Hall, P. O. and Gleeson, W. J. Spinal anesthesia with particular reference to its use in obstetrics. *Current Researches in Anesth. & Analg.*, 16: 234, 1937.
12. Co Tui. Present scientific status of spinal anesthesia. *Current Researches in Anesth. & Analg.*, 17: 146, 1938.
13. Crowley, R. T. Preparation and preservation of sterile citrated blood plasma by ampul tube method. *Surg., Gynec. & Obst.*, 71: 777, 1940.
14. Daily, E. F. Cesarean section, an analysis of 1000 consecutive operations. *Am. J. Obst. & Gynec.*, 37: 348, 1939.
15. DeLee, J. B. Year Book of Obstetrics and Gynecology. Chicago, 1939. The Year Book Publishers.
16. DeLee, J. B. The Principles and Practice of Obstetrics. 6th ed. Philadelphia and London, 1933. W. B. Saunders Co.
17. DeLee, J. B. The newer methods of cesarean section. *J. A. M. A.*, 73: 91, 1919.
18. DeLee, J. B. Year Book of Obstetrics and Gynecology. Chicago, 1935. The Year Book Publishers.
19. DeNormandie, R. L. Cesarean section in Massachusetts in 1937. *New England J. Med.*, 219: 871, 1938.
20. Duffield, T. J. Review of maternity statistics of N. Y. City for year 1939. *Bull. Acad. Med.*, 16: 679, 1940.
21. Edwards, F. R., Kay, J. and Davie, T. B. The preparation and use of dried plasma for transfusion. *Brit. M. J.*, 1: 337, 1940.
22. Eisaman, J. R. and Cook, J. M. Cesarean section, an analysis of 1322 cases. *Pennsylvania M. J.*, 42: 885, 1939.
23. Elliott, J., Bushby, G. F. and Tatum, W. L. Some factors in observations on preparation and preservation of dilute plasma. *J. A. M. A.*, 21: 1006, 1940.
24. Franken, H. Warum ist die Lumbalanästhesie beim Kaiserschnitt besonders gefährlich? *Zentralbl. f. Gynäk.*, 58: 2191, 1934.

25. FRANKL, O. On physiology and pathology of isthmus uteri. *J. Obst. & Gynaec., Brit. Emp.*, 40: 397, 1933.
26. FRASER, J. R. and SPARLING, D. Cesarean section. *Surg., Gynec. & Obst.*, 66: 437, 1938.
27. GELLE, P. Grossesse Gémellaire; Éclampsie; Césarienne Basse. *Bull. Soc. d'obst. et de gynec.*, 21: 62, 1932.
28. GOERRTLER, H. Die Architektur der Muskelwand des menschlichen Uterus and ihre funktionelle Bedeutung. *Morphol. Jahrb.*, 65: 45, 1930.
29. GORDON, C. A. Management of abruptio placentae. *Am. J. Surg.*, 35: 442, 1937.
30. GORDON, C. A. The management of prolapse of the uterus, with especial reference to the Manchester-Fothergill operation. *Am. J. Obst. & Gynec.*, 29: 4, 1933.
31. GORDON, C. A. Survey of cesarean section in the Borough of Brooklyn, City of New York. *Am. J. Obst. & Gynec.*, 16: 307, 1928.
32. GORDON, C. A. Puerperal mortality in the Borough of Brooklyn, City of New York. *Am. J. Obst. & Gynec.*, 41: 535, 1941.
33. GORDON, C. A. and ROSENTHAL, A. H. Sulfanilamide therapy in severe puerperal infection. *Surg., Gynec. & Obst.*, 69: 631, 1939.
34. GORDON, C. A. and ROSENTHAL, A. H. Use of sulfanilamide in obstetrics and gynecology. *Am. J. Obst. & Gynec.*, 40: 211, 1940.
35. GOTTSCHALK, (Discussion), KUSTNER, O. Eroprobtis zu schwebenden Kaiserschnittfragen. *Verbandl. d. deutsch. Gesselsch. f. Gynäk.*, 14: 651, 1911.
36. HAMILTON, B. E. Sixteen years experience with heart disease in pregnant women. *Am. Heart J.*, 14: 555, 1937.
37. HARRIS, J. W. and BROWN, J. H. The bacterial content of the uterus at cesarean section. *Am. J. Obst. & Gynec.*, 13: 133, 1927.
38. HARRISON, D. A., SHELTON, J. H. and CARRITHERS, C. M. Postmortem cesarean section in twin pregnancy with delivery of two living babies. *J. A. M. A.*, 110: 2066, 1938.
39. HILL, J. M., MUIRHEAD, E. E., ASHWORTH, C. T. and TIGERTT, W. D. The use of dessicated plasma. *J. A. M. A.*, 116: 395, 1941.
40. HILL, J. M. Intravenous use of concentrated plasma. *Texas State J. Med.*, 36: 223, 1940.
41. HIRST, B. C. Atlas of Operative Gynecology. P. 234. Philadelphia and London, 1919. J. B. Lippincott Co.
42. HOLLAND, E. Methods of performing cesarean section. *J. Obst. & Gynaec., Brit. Emp.*, 28: 350, 1921.
43. HOLLAND, E. The results of a collective investigation into cesarean sections performed in Great Britain and Ireland for the years 1911 to 1920 inclusive. *J. Obst. & Gynaec., Brit. Emp.*, 28: 358, 1921.
44. HOLLAND, E. Discussion on rupture of the cesarean section scar in subsequent pregnancy and labor. *Proc. Roy. Soc. Med.*, 14: 22, 1920.
45. HOLMES, R. (Discussion), FALLS, F. H. A critical study of the low cervical and classical cesarean section operations. *Am. J. Obst. & Gynec.*, 32: 989, 1936.
46. IRVING, F. C. Place of cesarean section. *J. Connecticut M. Soc.*, 1: 483, 1937.
47. IRVING, F. C. A simple method of performing extraperitoneal cesarean section in potentially infected cases. *Med. Rec. & Ann.*, Houston, Texas, August, 1937.
48. IRVING, F. C. Modern trends in the artificial termination of pregnancy and labor. *Am. J. Obst. & Gynec.*, 40: 621, 1940.
49. IRVING, F. C. The conservative treatment of premature separation of the normally implanted placenta. *Am. J. Obst. & Gynec.*, 34: 881, 1937.
50. JOSLIN, E. P. The Treatment of Diabetes Mellitus. 7th ed. Philadelphia, 1940. Lea and Febiger.

51. KEHRER, F. A. Ueber ein modificirtes Verfahren beim Kaiserschnitte. *Arch. f. Gynäk.*, 19: 177, 1882.
52. KERR, J. M. Technique of lower segment cesarean section. *Proc. Roy. Soc. Med.*, 29: 1645, 1936.
53. KERR, J. M. and HENDRY, J. Conservative cesarean section by lower uterine segment incision. *Surg., Gynec. & Obst.*, 43: 85, 1926.
54. KERR, J. M. Operative Obstetrics. 4th ed. Baltimore, 1937. William Wood & Co.
55. KING, E. L., DICKS, J. F., REDDOCH, J. W., STADIEM, M. L., ZANDER, E. L., MEYER, H. and MCCORMICK, E. P. A review of the cesarean sections performed in New Orleans during the years 1927 to 1936 inclusive. *New Orleans M. & S. J.*, 90: 731, 1938.
56. KING, E. L. A comparison of two cesarean section surveys carried out in the City of New Orleans. *Am. J. Obst. & Gynec.*, 40: 860, 1940.
57. LATZKO, W. Ueber den extraperitonealen Kaiserschnitt. *Zentralbl. f. Gynäk.*, 33: 275, 1909.
58. LAZARD, E. M. An analysis of 507 consecutive cases of cesarean section. *West. J. Surg.*, 46: 6, 1938.
59. LAZARD, E. M. Sterilization procedures on women. *West. J. Surg.*, 48: 294, 1940.
60. LEVINSON, S. O., NEUWELF, F. and NECHELES, H. Human serum as a blood substitute in the treatment of hemorrhage and shock. *J. A. M. A.*, 114: 455, 1940.
61. LUSK, W. T. The Science and Art of Midwifery. New York, 1890. D. Appleton and Co.
62. LYNCH, F. W. More conservatism in cesarean section. *Surg., Gynec. & Obst.*, 64: 338, 1937.
63. MCSWEENEY, D. J. Cesarean section for the ninth time. *Am. J. Obst. & Gynec.*, 39: 155, 1940.
64. MARSHALL, C. MCI. Cesarean Section Lower Segment Operation. Baltimore, 1939. The Williams and Wilkins Co.
65. MATTHEWS, H. B. and ACKEN, H. C. A critical survey of 1066 cesarean sections. *Am. J. Obst. & Gynec.*, 38: 956, 1939.
66. MENGERT, W. F. and LAUGHLIN, K. A. Thirty-three pregnancies in diabetic women. *Surg., Gynec. & Obst.*, 69: 615, 1939.
67. MILLER, H. C. The effect of methods of delivery, particularly cesarean section, on fetal neonatal mortality. *West. J. Surg.*, 48: 13, 1940.
68. MONTGOMERY, T. L. The immediate and the remote effect of abdominal cesarean section. *Am. J. Obst. & Gynec.*, 31: 968, 1936.
69. MOON, V. H. Shock and Related Capillary Phenomena. New York, 1938. Oxford Medical Publications.
70. New Orleans Gynecological and Obstetrical Society—A study of the cesarean sections performed in the hospitals of New Orleans from 1921 throughout 1926. *New Orleans M. & S. J.*, 79: 815, 1927.
71. New York Academy of Medicine. Maternal Mortality in New York City 1930–1932. The Commonwealth Fund, N. Y., 1933.
72. PASTORE, J. B. and STANDER, H. J. Hemorrhage in obstetrical patients. *Texas State J. Med.*, 35: 390, 1939.
73. PHANEUF, L. E. Cesarean section followed by temporary exteriorization of uterus; Portes operation. *Surg., Gynec. & Obst.*, 4: 788, 1927.
74. PHANEUF, L. E. The progress of cesarean section. *Am. J. Obst. & Gynec.*, 40: 603, 1940.
75. PLASS, E. D. The relation of forceps and cesarean section to maternal and infant morbidity and mortality. *Am. J. Obst. & Gynec.*, 22: 176, 1931.

76. Plass, E. D. General indications and contraindications for operative delivery. *J. Iowa M. Soc.*, 28: 473, 1938.
77. Porro, E. Dell' amputazione utero-ovarica come complemento di taglio cesareo. *Ann. univ. de med.*, 237: 291, 1876.
78. Porter, R. D. Diabetes: management of pregnancy in diabetes. *Pennsylvania M. J.*, 44: 148, 1940.
79. Portes, L. Modified extraperitoneal cesarean section. *Bull. Soc. d'obst. et de gynéc.*, 10: 225, 1924.
80. Quigley, J. K. Cesarean section. A ten year study conducted in Rochester and Monroe County. *New York State J. Med.*, 40: 699, 1940.
81. Reynolds, E. The superiority of primary over secondary cesarean section. *Surg., Gynec. & Obst.*, 5: 236, 1907.
82. Reynolds, S. R. Physiology of the Uterus. New York and London, 1939. Paul B. Hoeber, Inc.
83. Rosenthal, A. H. and Stone, F. M. Puerperal infection with vegetative endocarditis; report of sulfanilamide therapy in two fatal cases due to streptococcus hemolyticus groups B. and C. *J. A. M. A.*, 114: 840, 1940.
84. Routh, A. On cesarean section in the United Kingdom. *J. Obst. & Gynaec., Brit. Emp.*, 19: 235, 1911.
85. Schumann, E. A. Critique of factors involved in cesarean section mortality. *Am. J. Obst. & Gynec.*, 37: 212, 1939.
86. Schwarz, O. H., Paddock, R. and Bortnick, A. R. The cesarean scar; an experimental study. *Am. J. Obst. & Gynec.*, 36: 962, 1938.
87. Scudder, J., Bishop, K. and Drew, C. R. Studies in blood preservation; the shape of the container. *J. A. M. A.*, 115: 290, 1940.
88. Selheim, H. Der Extraperitoneale Uterusschnitt. *Zentralbl. f. Gynäk.*, 32: 133, 1908.
89. Shaw, W. F. Cesarean section for the seventh time. *J. Obst. & Gynaec., Brit. Emp.*, 28: 547, 1921.
90. Sisson, W. R. Neonatal problems in infants of diabetic mothers. *J. A. M. A.*, 115: 2040, 1940.
91. Smith, E. F. Transcervical cesarean section with peritoneal exclusion and bladder mobilization. *Am. J. Obst. & Gynec.*, 39: 763, 1940.
92. Stander, H. J. Williams Obstetrics. 8th ed. New York and London, 1941. D. Appleton-Century Co.
93. Strumia, M. M., Wagner, J. A. and Monaghan, J. F. The intravenous use of serum and plasma fresh and preserved. *Ann. Surg.*, 111: 623, 1940.
94. Thoms, H. The Obstetric Pelvis. Baltimore, Md., 1940. The Williams and Wilkins Co.
95. United States Department of Labor, Children's Bureau, Maternal Mortality in Fifteen States—Publication No. 233, Washington, D. C., 1934.
96. Waters, E. G. Supravesical extraperitoneal cesarean section; presentation of a new technique. *Am. J. Obst. & Gynec.*, 39: 423, 1940.
97. Weiner, A. S. Blood Groups and Blood Transfusion, 2nd ed. Springfield, Ill., and Baltimore, Md., 1939. Charles C. Thomas.
98. Wetterwald, M. Zur Frage der Uterusruptur nach cervicaler transperitonealer Schnittentbindung. *Zentralbl. f. Gynäk.*, 50: 592, 1926.
99. Wetterwald, M. A Propos de l'Avenir Obstétrical des Femmes Ayant Subi La Cesarenne Transperitoneale Basse. *Gynéc. et obst.*, 13: 131, 1926.
100. White, P. and Hunt, H. Prediction and prevention of pregnancy accidents in diabetes. *J. A. M. A.*, 115: 2039, 1940.



A TEXT BOOK OF MODERN X-RAY TECHNIC AND PROCEDURE

Containing more than 200 pages of comprehensive information on every phase of radiographic technic, the new edition, "Outline of Modern X-Ray Technic"—will be welcomed by everyone engaged in x-ray procedure.

Over 270 pertinent illustrations graphically portray the latest innovations in x-ray technic and procedure. Much time and effort were devoted to contact and research, covering the entire field of radiographic-fluoroscopic work in x-ray laboratories throughout the nation.

Although the major portion of the volume pertains to the preparation and positioning of the patient, together with photographs, diagrams and radiographs, several chapters deal with the physics of x-ray and electrical circuits of modern shockproof equipment.

Printed on coated stock 8½ inches by 11 inches and beautifully bound in simulated pigskin leather, "Outline of Modern X-Ray Technic" will make a significant addition to your library. Price, $4.50 per copy.

PICKER X-RAY PX CORPORATION

300 FOURTH AVENUE NEW YORK, NEW YORK

WAITE MANUFACTURING DIVISION, CLEVELAND, OHIO

(Number five in a series of six.)

Common problems in the management of peptic ulcer

"What will best control 'Night Pain' in the peptic ulcer patient?"

Four drams of Amphojel* given at bedtime exert a prolonged antacid effect usually lasting until morning. The patient sleeps more comfortably.

Four striking features of Amphojel, Wyeth's Alumina Gel, are recognized by clinicians:

Amphojel provides prompt relief from pain. It permits rapid healing of the ulcer. It cannot be absorbed and eliminates the hazard of alkalosis. It reduces excess acidity without completely neutralizing the gastric contents.

" " "

Amphojel, Wyeth's Alumina Gel

Fluid Antacid . . . Adsorbent

One or two teaspoonfuls either undiluted or with a little water, to be taken five or six times daily, between meals and on retiring.

Supplied in 12-ounce bottles

AMPHOJEL

Wyeth's Alumina Gel

For the Convenience of Ambulatory Patients

Wyeth's Hydrated Alumina Tablets

Antacid

One-half or one tablet in half a glass of water. Repeat five or six times daily, between meals and on retiring.

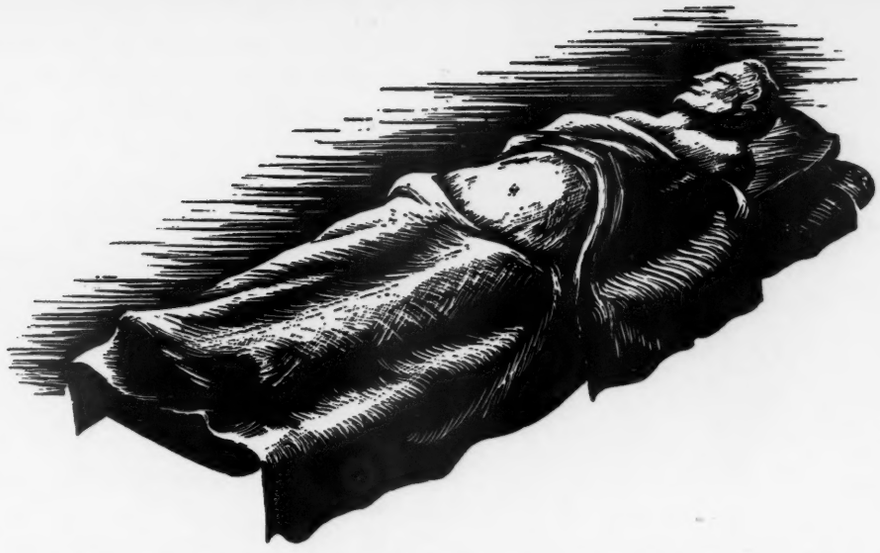
Supplied in boxes of 60 tablets

*REG. U. S. PAT. OFF.

JOHN WYETH AND BROTHER, INC., PHILADELPHIA, PA.

Neo-Iopax

AND THE SURGICAL ABDOMEN



INCREASE ACCURACY IN DIAGNOSIS

As high as 75% of error may occur in the differential diagnosis of GI and GU tract disease. In a large series of urological cases, fully 49% of patients had previously had an abdominal or pelvic operation *without correcting the pathology* (J. Urol. 23:247, 1930). Surgeons find NEO-IOPAX a valuable aid in differential diagnosis. It furnishes reliable intravenous urograms with relative safety, convenience and simplicity ...vivid pictures which help to clarify puzzling abdominal symptoms.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Pharmacy and Chemistry

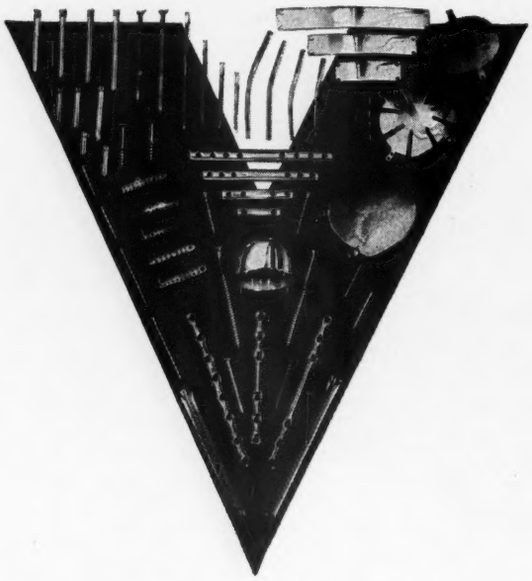
Brief, simple injection of a single ampule of NEO-IOPAX will give a clear-cut, vivid shadow. NEO-IOPAX is chemically stable, has an optimally high iodine content, and is rapidly excreted in high concentration. There are but few contraindications: nephritis, liver damage, uremia. Iodine is apparently not liberated appreciably in the body (J.A.M.A. 114:347, 1940), but caution is enjoined in tuberculosis, hyperthyroidism and severe systemic disease.

NEO-IOPAX* is Schering's disodium N-methyl-3:5-diiodo-chelidamate.

*Trade-Mark Reg. U.S. Pat. Off.

SCHERING CORPORATION • BLOOMFIELD • NEW JERSEY

VITALLIUM
SURGICAL APPLIANCES



TRADEMARK REG. U. S. PAT. OFFICE

The only true Cobalt-Chromium alloy being used in bone surgery

VITALLIUM nails, screws, plates, hip caps and special appliances have an authentic operative and clinical success that is without parallel in the internal fixation of fractures.

Order through your dealer

*Campbell, W. C. and Speed, J. S., Annals of Surgery, 110-1. July, 1939. • Berry, H. C., Journal of Arkansas State Dental Association, 10-2. June, 1939. • Strock, A. E., American Journal of Orthodontics & Oral Surgery, 25-5. May, 1939. • Doherty, W. B., American Journal of Ophthalmology, 22-4. April, 1939. • Smith-Petersen, M. N., The Journal of Bone & Joint Surgery, 21-2, April, 1939. • Claflin, R. S., American Journal of Orthodontics & Oral Surgery, 25-1. January, 1939. • Hopkins, H. H. and Zuck, F. N., Medical Bulletin of Veterans' Administration, 15-3. January, 1939. • Venable, C. S. and Stuck, W. G., Journal of American Medical Association, 11-15. October 8, 1938.

AUSTENAL LABORATORIES, Inc.
NEW YORK • CHICAGO

HYDROSULPHOSOL
for Burns

Establishes a thin, pliable eschar quickly. Add one part HYDROSULPHOSOL solution to one part distilled water and spray on injured area with ordinary rubber bulb syringe. . . . HYDROSULPHOSOL ointment for ambulatory cases and minor burns.

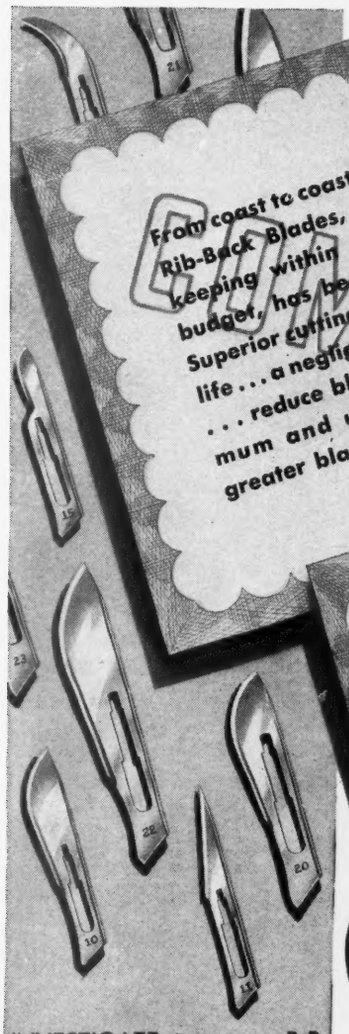
Write for Reprints

E. C. Lisntz and Co., Inc. ★ ★ ★ ★
1006 WEST SIXTH STREET, LOS ANGELES, CALIF.
REPRESENTING COTTIE-WILSON LABORATORIES

RIB-BACK BLADES

afford the Hospital Buyer and Surgeon a participating interest

in the most widely endorsed stock of surgical blades available



ECONOMY

From coast to coast the use of Bard-Parker Rib-Back Blades, as a logical means of keeping within the carefully controlled budget, has become a *common* practice. Superior cutting efficiency . . . longer blade life . . . a negligible percentage of discards . . . reduce blade consumption to a minimum and undeniably contribute to greater blade economy.

PREFERRED

As Rib-Back Blades are built up to a quality—not down to a price, they are the acknowledged *preference* of discriminating surgeons to whom quality is the prime requisite. Rigid factory inspection control eliminates, at the source, all blades not meeting our exacting standards of sharpness and strength. Inferior blades are not permitted to reach the surgery to be rejected at a critical moment.

It's Sharp

INVESTIGATE two new B-P HANDLE innovations.

DISTAL ENDS . . . redesigned for use in blunt dissection.

ELONGATED HANDLES . . . for deep surgery.

Ask your dealer

BARD-PARKER COMPANY, Inc.
DANBURY, CONNECTICUT

B-P

A BARD-PARKER PRODUCT

Society Meetings

AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

New Orleans, January 12–16, 1941. (Secretary—DR. CARL BADGLEY, University Hospital, Ann Arbor, Mich.)

AMERICAN ASSOCIATION FOR THE STUDY OF GOITER

Boston, May 12–14, 1941. (Secretary—DR. W. BLAIR MOSSER, Kane, Penna.)

AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA

Seigniory Club, Montreal, Que., May 29-31, 1941. (Secretary—DR. RALPH G. CAROTHERS, 409 Broadway, Cincinnati)

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

Hot Springs, Va., May 29–31, 1941. (Secretary—DR. CHARLES C. HIGGINS, 2020 East 93rd Street, Cleveland)

AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS

Pittsburgh, May 5–9, 1941. (Secretary—MR. ARMOUR G. PARK, 540 N. Michigan Ave., Chicago)

AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS

Hot Springs, Va., September 11–13, 1941. (Secretary—DR. JAMES R. BLOSS, 418—11th St., Huntington, W. Va.)

AMERICAN ASSOCIATION OF RAILWAY SURGEONS

Chicago, September 8–10, 1941. (Secretary—DR. R. B. KEPNER, 547 W. Jackson Blvd., Chicago)

AMERICAN COLLEGE OF SURGEONS

Boston, November 3–7, 1941. (Secretary—DR. FREDERIC A. BESLEY, 215 N. Sheridan Rd., Waukegan, Ill.)

AMERICAN CONGRESS OF PHYSICAL THERAPY

Washington, D. C., September 1–5, 1941. (Secretary—DR. RICHARD KOVACS, 2 East 88th Street, New York)

AMERICAN GYNECOLOGICAL SOCIETY

Colorado Springs, May 26–28, 1941. (Secretary—DR. RICHARD W. TELINDE, Johns Hopkins Hospital, Baltimore)

AMERICAN MEDICAL ASSOCIATION

Cleveland, June 2–6, 1941. (Secretary—DR. OLIN WEST, 535 N. Dearborn Street, Chicago)

AMERICAN ORTHOPAEDIC ASSOCIATION

Toronto, Can. June 9–12, 1941. (Secretary—DR. C. W. PEABODY, 474 Fisher Bldg., Detroit)

AMERICAN PROCTOLOGIC SOCIETY

Cleveland, June 1–3, 1941. (Secretary—DR. W. H. DANIEL 1930 Wilshire Blvd., Los Angeles)

THE AMERICAN SOCIETY OF ANESTHETISTS, INC.

New York, December 11, 1941. (Secretary—DR. PAUL M. WOOD, 745 Fifth Avenue, New York)

AMERICAN SURGICAL ASSOCIATION

White Sulphur Springs, W. Va., April 28–30, 1941. (Secretary—DR. CHARLES G. MIXTER, 319 Longwood Avenue, Boston)

ASSOCIATION OF MILITARY SURGEONS OF THE U. S.

Louisville, Ky., October 29–November 1, 1941 (Secretary—COL. JAMES M. PHALEN, 1870 Wyoming Ave., N.W., Washington, D. C.)

CONGRESS OF ANESTHETISTS

Boston, November 3–7, 1941. (Secretary—DR. E. KLAUS, 1699 W. 25th Street, Cleveland)

INTERNATIONAL COLLEGE OF SURGEONS

Mexico City, August 10–14, 1941. (Secretary—DR. CHARLES H. ARNOLD, 903-15 Terminal Bldg., Lincoln, Nebr.)

INTER-STATE POST-GRADUATE MEDICAL ASSOCIATION OF NORTH AMERICA

Minneapolis, October 13–17, 1941. (Secretary—DR. TOM B. THROCKMORTON, 406 Sixth Avenue, Des Moines)

NEW ENGLAND SURGICAL SOCIETY

Hanover, N. H., September 5–6, 1941. (Secretary—DR. JOHN F. GILE, Hanover, New Hampshire)

PACIFIC COAST SOCIETY OF OBSTETRICS AND GYNECOLOGY

Pasadena, Cal., November 5–8, 1941. (Secretary—DR. W. B. THOMPSON, 6253 Hollywood Blvd., Los Angeles)

PACIFIC COAST SURGICAL ASSOCIATION

Los Angeles, February 19–22, 1941. (Secretary—DR. H. GLENN BELL, University of California Hospital, San Francisco)

PAN-PACIFIC SURGICAL ASSOCIATION

Honolulu, 1942. (Secretary—DR. FORREST J. PINKERTON Young Bldg., Honolulu)

SOUTHEASTERN SURGICAL CONGRESS

Richmond, Va., March 10–12, 1941. (Secretary—DR. B. T. BEASLEY, 701 Hurt Bldg., Atlanta)

SOUTHERN SURGICAL ASSOCIATION

Pinehurst, N. C., December 9–11, 1941. (Secretary—DR. ALTON OCHSNER, 1430 Tulane Avenue, New Orleans)

WESTERN SURGICAL ASSOCIATION

St. Paul, Minn., December 5–6, 1941. (Secretary—DR. ARTHUR METZ, 2449 Washington Blvd., Chicago)

THE NEW YORK POLYCLINIC
MEDICAL SCHOOL AND HOSPITAL
(ORGANIZED 1881)

(The Pioneer Post-Graduate Medical Institution in America.)

EYE, EAR, NOSE and THROAT

A combined full-time course covering an academic year (9 months), consisting of attendance at clinics, witnessing operations, lectures, demonstration of cases and cadaver demonstrations; operative eye, ear, nose and throat on the cadaver; head and neck dissection (cadaver); clinical and cadaver demonstrations in bronchoscopy and facial palsy; refraction; roentgenology; pathology, bacteriology and embryology; physiology; neuro-anatomy; anesthesia; physical therapy; allergy; examination of patients pre-operatively and follow-up post-operatively in the wards and clinics; work in the out-patient department as assistant.

Special arrangements can be made for shorter courses.

PHYSICAL THERAPY

Didactic lectures and active clinical application of all present-day methods of physical therapy in internal medicine, general and traumatic surgery, gynecology, urology, dermatology, neurology and pediatrics. Special demonstrations in minor electrosurgery, electrodiagnosis, fever therapy, hydrotherapy including colonic therapy, light therapy.

FOR INFORMATION ADDRESS

MEDICAL EXECUTIVE OFFICER, 345 West 50th Street. NEW YORK CITY

COOK COUNTY
GRADUATE SCHOOL OF MEDICINE
(In affiliation with COOK COUNTY HOSPITAL)

Incorporated not for profit

Announces continuous courses

SURGERY—Two Weeks Intensive Course in Surgical Technique with practice on living tissue, starting every two weeks. General Courses One, Two, Three and Six Months; Clinical Courses; Special Courses. Rectal Surgery every week.

GYNECOLOGY—Two Weeks Intensive Course will be offered four times during the year 1942, dates to be announced. Clinical and Diagnostic Courses every week.

OBSTETRICS—Two Weeks Intensive Course will be offered twice during the year 1942, dates to be announced. Informal Course every week.

ROENTGENOLOGY—Courses in X-Ray Interpretation, Fluoroscopy, Deep X-Ray Therapy every week.

MEDICINE—Two Weeks Intensive Course in Internal Medicine, and Two Weeks Course in Gastro-Enterology will be offered twice during the year 1942, dates to be announced. One month Course in Electrocardiography and Heart Disease every month, except December.

FRACTURES & TRAUMATIC SURGERY—Two Weeks Intensive Course will be offered four times during the year 1942, dates to be announced. Informal Course available every week.

OTOLARYNGOLOGY—Two weeks Intensive Course will be offered twice during the year 1942, dates to be announced. Clinical and Special Courses starting every week.

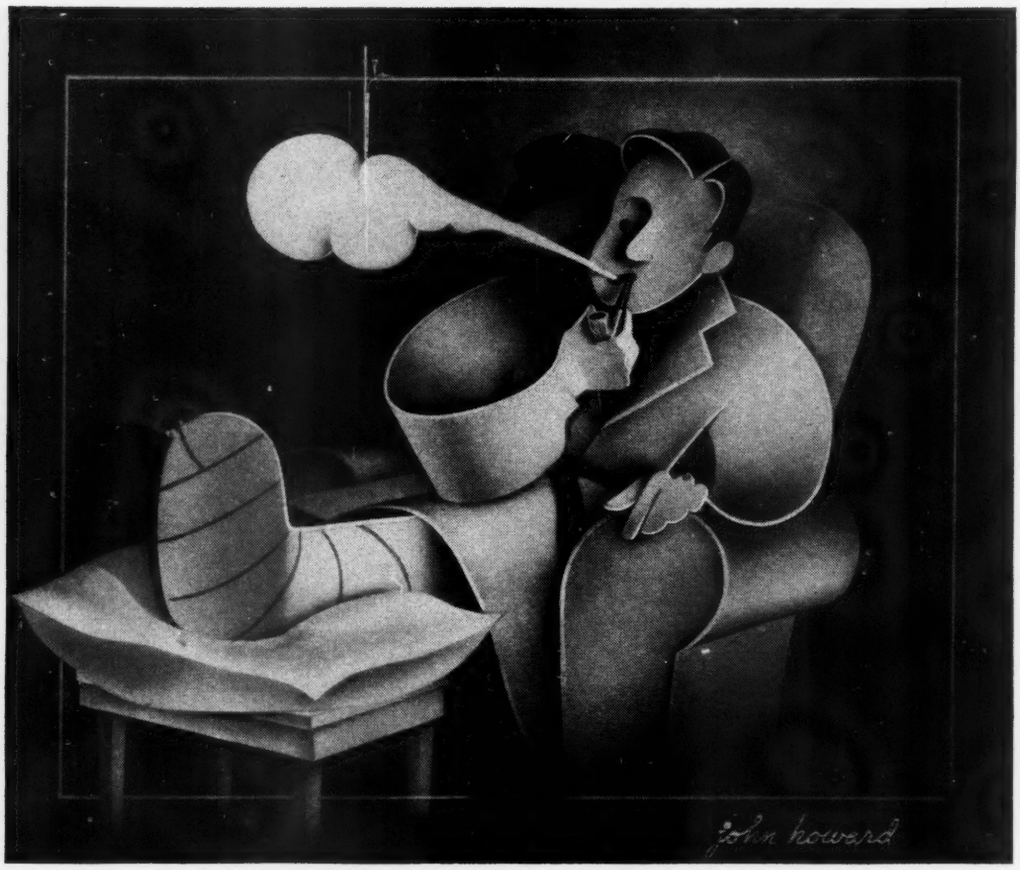
OPHTHALMOLOGY—Two Weeks Intensive Course will be offered twice during the year 1942, dates to be announced. Informal Course every week.

GENERAL, INTENSIVE AND SPECIAL COURSES IN ALL BRANCHES OF MEDICINE, SURGERY AND THE SPECIALTIES

Teaching Faculty—Attending Staff of

COOK COUNTY HOSPITAL

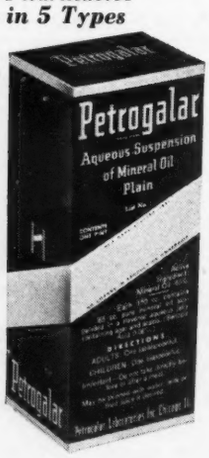
Address: Registrar, **427 South Honore Street, Chicago, Illinois**



For the Stay-at-Home

★ ★ ★ Petrogalar*

★ *Available at all Pharmacies in 5 Types*



Shut in—No exercise—Appetite off—Sluggish bowel, all suggest the use of Petrogalar to assist Bowel Habit Time.

Petrogalar Plain adds unabsorbable fluid to the bowel content to encourage regular, comfortable elimination by purely mechanical means, free of habit-forming tendencies.

Children and adults alike enjoy the delightful flavor of Petrogalar. It is easy to take, either from a spoon or in water, as desired.

Trade Mark. Petrogalar is an aqueous suspension of pure mineral oil each 100 cc. of which contains pure mineral oil suspended in an aqueous jelly containing agar and acacia.

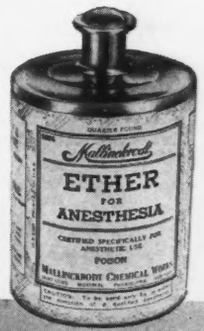
Petrogalar Laboratories, Inc. • 8134 McCormick Boulevard • Chicago, Illinois

An Aseptic Field . . .

A Sure Hand . . .

A Reliable Anesthetic

When the anesthetic bears the Mallinckrodt label, surgeons, anesthetists and doctors can place implicit reliance in its performance. Modern as the newest shadowless operating lights, Mallinckrodt anesthetics are products of thousands upon thousands of research hours. Successful use in millions of operative procedures attests their uniform efficiency, purity and stability. Before release, every Mallinckrodt anesthetic is subjected to careful chemical analysis as a *final check* of its purity and uniformity.



MALLINCKRODT ETHER for Anesthesia

Other Widely Used Mallinckrodt Anesthetics

Procaine Hydrochloride U.S.P. XI
Paraldehyde U.S.P. XI
MALLINCKRODT Cyclopropane* U.S.P. XI
Chloroform U.S.P. XI for Anesthesia

***Cyclopropane (Mallinckrodt) may also be obtained through the various offices of the Puritan Compressed Gas Corporation of Kansas City.**

MALLINCKRODT CHEMICAL WORKS

St. Louis New York Philadelphia Chicago Montreal Toronto

MADE IN U. S. A.

DEKNATEL SURGICAL SILK'S certain and easy manipulation . . . . extra tensile strength . . superiority where wet dressings are used . . . splinterless smooth surface . . . resistance to action of enzymes, catalyzers, lochial discharges, vaginal acids . . . soft knots and ends . . . strong smaller sizes . . . and other distinctive qualities . . . have brought it into standard practice with innumerable hospitals and surgeons.

DEKNATEL SURGICAL SILK is round and uniform—ends do not unravel—and is easily threaded. It comes in 12 sizes (black or white), for the various operations.

Write for Sample for Trial Use

Also commended to the surgeon's use are Deknatel Surgical Nylon and Deknatel Eyeless Needle

SHORT TALKS ON WOUND DRESSING

Azochloramid
N-N'-DICHLOROAZODICARBONAMIDINE
MEETS THE CHALLENGE OF INFECTION

An organic chlorine compound available in both oily and aqueous solutions. Virtually non-toxic, relatively non-irritating, will not stain. Distinguished from other chlorine compounds by unusual stability—the solutions remain active for long periods within a wound, even in the presence of necrotic tissue, sequestra, etc. Effective against all types of microorganisms.

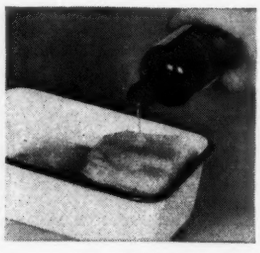
ECONOMICAL

Dressings may be prepared in advance and used as needed. One ounce of Azochloramid in Triacetin 1:500 will adequately medicate about six 3"x3" gauze squares at a cost of less than 2c each. One square is suitable for such an extensive lesion as an abdominal wall infection following appendectomy, a fairly large varicose ulcer, etc. The dressing need not be changed more often than once every 24 hours—assuring continuous therapeutic effect and minimizing the possibility of trauma and discomfort to patient.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Pharmacy and Chemistry

Prevent infection with AZOCHLORAMID

For the prevention or control of infection in post-operative and traumatic wounds Azochloramid preparations have been used with outstanding results. In frankly infected wounds the use of Azochloramid generally results in a decrease of pain, fever and regional lymphatic involvement without appreciable damage to vital tissue cells.



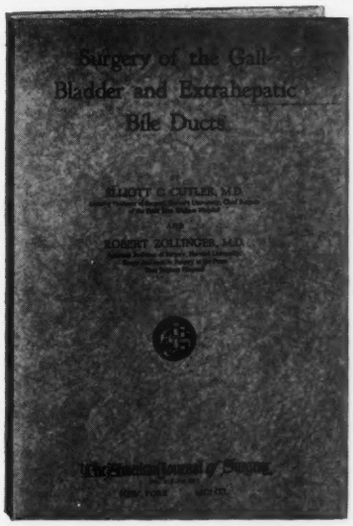
Trial supply sent to physicians on request

WALLACE & TIERNAN PRODUCTS, INC.
Belleville,
New Jersey, U. S. A.

BOUND MONOGRAPHS

FROM THE 1940-41 ISSUES

The American Journal of Surgery



Surgery of the Gall-Bladder and Extrahepatic Bile Ducts—by Elliott C. Cutler and Robert Zollinger. 76 pages

The Estimation of Pelvic Capacity—By Herbert Thoms. 46 pages

Placenta Previa—By Julius Jarcho. 38 pages

The Diagnosis and Treatment of Hyperthyroidism and Associated Conditions—By Arthur Goetsch. 64 pages

The Surgery of Mediastinal Tumors—By George J. Heuer and William Andrus. 80 pages

Diagnosis and Treatment of Various Types of Diaphragmatic Hernia—By Stuart W. Harrington. 66 pages

Surgical Aids to the Intracavitary Treatment and Study of Cancer of the Stomach—By Edward M. Livingston and George T. Pack. 98 pages

Cancer of the Tonsil—By Hayes Martin and Everett L. Sugarbaker. 40 pages

Urology in the Female—By Houston S. Everett. 136 pages

Compression of Cancellous Bone—By Eugene J. Bozsan. 78 pages

IN PREPARATION

Cesarean Section—By Charles A. Gordon and Alexander H. Rosenthal
(Ready about December 1, 1941)

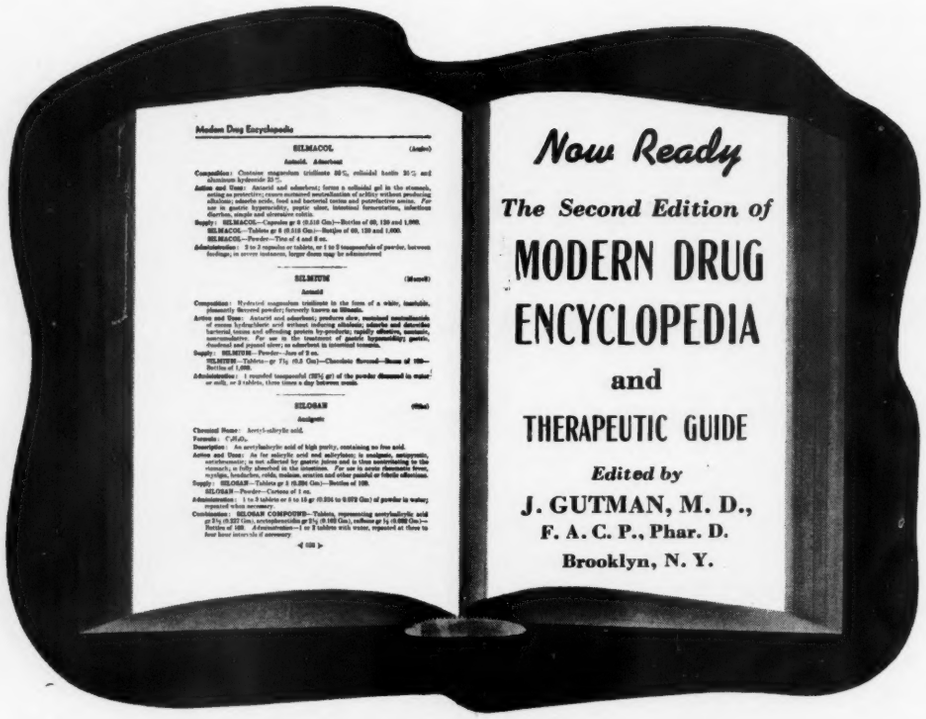
Cancer of the Gums (Gingivae)—By Hayes Martin
(Ready about January 1, 1942)

Just 250 Numbered, Paper Bound, Copies of Each Printed

$1.00 per copy

The American Journal of Surgery, Inc.

49 WEST 45TH STREET · NEW YORK, N. Y.



A Quick Reference Desk Service on 11,114 Medicinal Specialties of 291 Manufacturers

- **Presents the Composition, Action and Uses, Supply, Administration and Cautions of the ethical medicinal preparations used in the United States.**
- **Three Indices—Drug, Manufacturers' and Therapeutic—make for quick reference.**

The Second Edition has been completely revised, rewritten and reset.

Kept up to date with FREE supplementary service issued every three months—complete with cumulative index.

DRUGS
BIOLOGICALS
ENDOCRINES
HYPODERMICS
ALLERGENS
TOPICAL DRUGS

Handsomely Bound
1664 Pages
$10.00

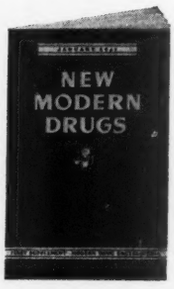
NEW MODERN DRUGS
49 West 45th Street, New York, N. Y.

Enclosed find remittance in the sum of ten dollars ($10.00) for which please send me postpaid Gutman's MODERN DRUG ENCYCLOPEDIA AND THERAPEUTIC GUIDE and FREE quarterly issues of NEW MODERN DRUGS.

(Remittance Must Accompany Order)

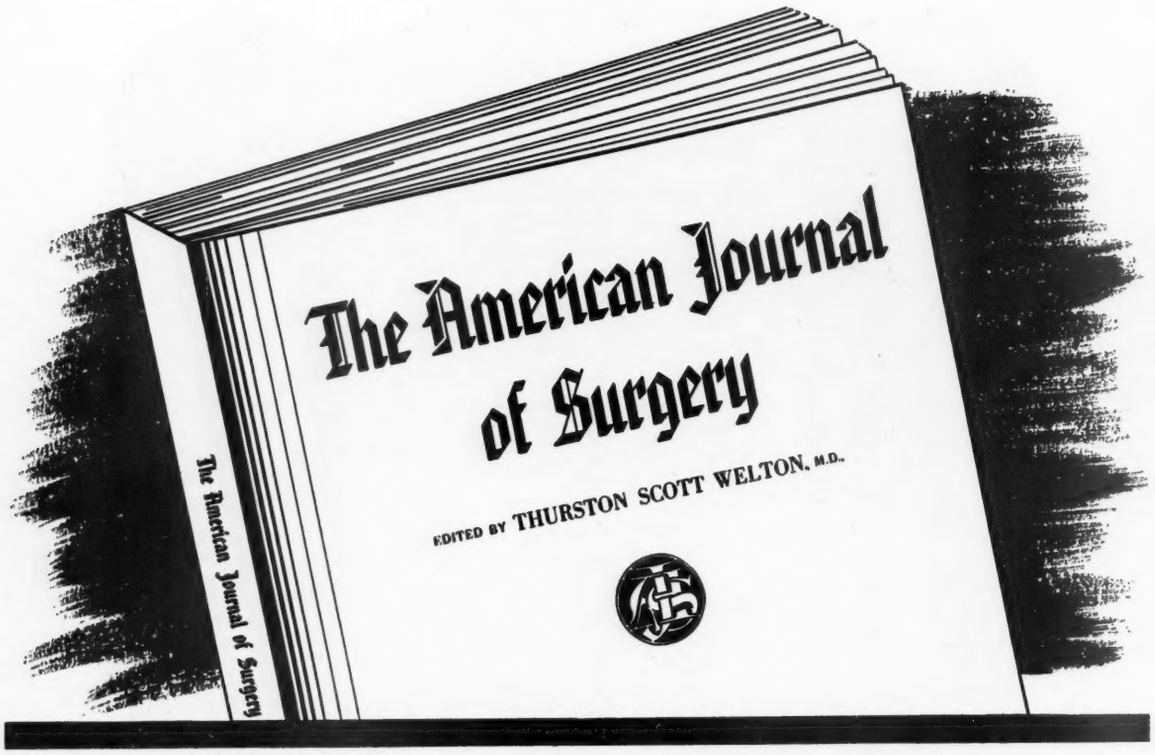
Name _____

Address _____



CRESCENT
THE MASTER HAND
deserves
A MASTER BLADE
NO good operator tolerates less than the best! That's why so many insist on Crescent blades—the physical realization of the surgeon's will to clean, effortless incision.
They're sharper—with cutting edge ground to a longer, flatter bevel.
They're more rigid—incorporating one-third more of the finest surgical steel.
They're better balanced—with weight evenly distributed (no thinning down from the back).
Performance in your hand can alone tell the whole story. If you're not using Crescent blades, send for samples, and put their superiority to the test—now! Call your surgical dealer... or write to
CRESCENT SURGICAL SALES CO., Inc., New York
CRESCENT
SURGICAL BLADES

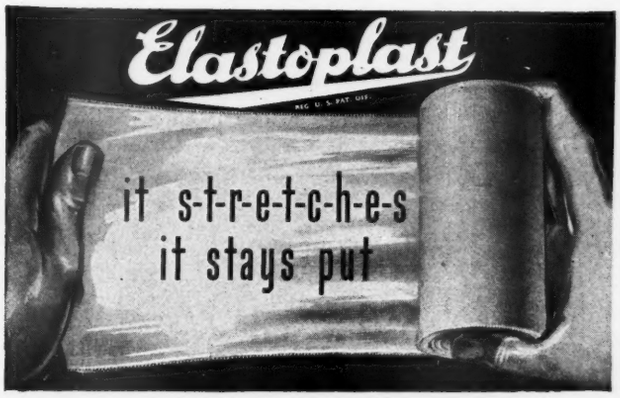
SNUG FITTING WRIST
HOLDS FIRM
WON'T ROLL
SNUG FITTING WRISTS
PROVIDE GREATER COMFORT
LARGER HERE
THAN HERE
SMALLER HERE
THAN HERE
STRAIGHT SIDED DESIGN
MATEX DESIGN
Matex surgeons gloves won't slip down. The slightly smaller cuff diameter (see sketch) makes them cling snugly to the wrist to provide that comfort and ease that adds facility to hands and fingers. Insist upon modern designed surgeons gloves. Specify Matex.
Matex Last Longer



Coming!

December	CANCER OF THE GUMS (Gingivae) By Hayes Martin, New York	Monograph
February	PAPERS OF THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA	Special Number
April	DIAGNOSIS IN SURGICAL CONDITIONS Guest Editor James T. Priestley, Rochester, Minn.	Symposium

THE LEADING INDEPENDENT SURGICAL JOURNAL



For Comfort . . .

Neatness . .

For Support . . .

Compression .

The Dependable Original E-L-A-S-T-I-C-Adhesive Bandage

ELASTOPLAST

Moulds and holds to any contour . . . Allows joint motion . . . Provides firm support and controllable compression . . . Does not slip. Assures the neatest, most comfortable dressing in private and hospital practice.

Write for samples of Elastoplast and Nivea — the surgeon's hand lotion for dry, chapped skin.

DUKE LABORATORIES, INC., STAMFORD, CONN.

Vanco Sanitary Sheet Apparatus

A Clean Sheet for Every Patient

A NEW CLEAN, WHITE PAPER SHEET IS PULLED DOWN ON THE EXAMINING TABLE.

BY A SIMPLE TEAR, THE SHEET IS REMOVED FROM THE TABLE.

COVERED AGAIN WITH A NEW SHEET, THE TABLE IS READY FOR THE NEXT PATIENT.

Adjustable and easily attached to either wood or metal table, this *Vanco* fixture holds approximately 300 sheets of soft, snow-white paper of special pliable texture.

Fastidious patients will welcome this innovation. Neat. Sanitary. Comfortable. An ingenious device prevents slipping of sheet, and affords complete protection for your patients.

No more laundry bills. No more expense for new linen. Vanco complete $10.50 each. Extra rolls (approximately 300 applications) $3.00 each.

Write for literature.

Order through your dealer.

FRED HASLAM & CO., INC. **83 Pulaski St. Brooklyn, N. Y.**

USE

LAVORIS

When Colds Are Prevalent

Keep the mouth and throat thoroughly clean

IODINE

THE SURGEON'S GREAT ALLY

As a skin disinfectant, for use prior to surgical operation and as a wound antiseptic, Iodine is the surgeon's great ally.

For more than a century, Iodine has been chosen by medical men the world over to prevent sepsis.

Iodine's leadership throughout all the years has been due to its high germicidal value, its proven penetrating power and its relatively low toxic action on body tissue.

Send for free reprint, "Preparation for Surgery." Address Dept. F-11.

IODINE EDUCATIONAL BUREAU, INC.

120 BROADWAY NEW YORK, N. Y.

IMPORTANT USES FOR KNOX GELATINE IN CONVALESCENCE

Not only is there difficulty in supplying protein to rebuild losses of body protein during illness, but after illness it is important to stimulate appetite by appeal to eye as well as to palate.

During severe illness the loss of body protein may greatly exceed the supply.

- Concentrated protein which is easily digested will help spare body proteins and aid in the repair and replacement of essential tissues.
- The fluid and soft diet during illness and convalescence can easily be supplemented with the Knox Gelatine Drink* (in water, fruit juice or milk), a concentrated source of easily digested protein.
- Knox Gelatine contains a majority of the known amino acids making up proteins, including 7 of the 10 considered "essential." (Amino acid analysis on request.)

*To prepare, pour 1 envelope Knox Gelatine into ¾ glass water, fruit juice or milk, not iced. Let liquid absorb gelatine. Stir. Drink immediately. If gelatine thickens, stir again.

Attractive preparation of food is an important factor in the convalescent diet.

- The delicious value of Knox Plain Gelatine dishes has a psychological effect which aids proper digestion and assimilation.
- With Knox Plain Gelatine the various protective foods can be combined into dishes that are rich in three essential food elements: vitamins, minerals, protein.

The coupon below will bring you dietary leaflets and additional information on the varied uses of Knox Gelatine in cases where extra supplementary protein intake is indicated. Your hospital will procure Knox Gelatine for your patients if you specify it by name.

KNOX GELATINE (U.S.P.)

IS PLAIN, UNFLAVORED GELATINE—ALL PROTEIN, NO SUGAR

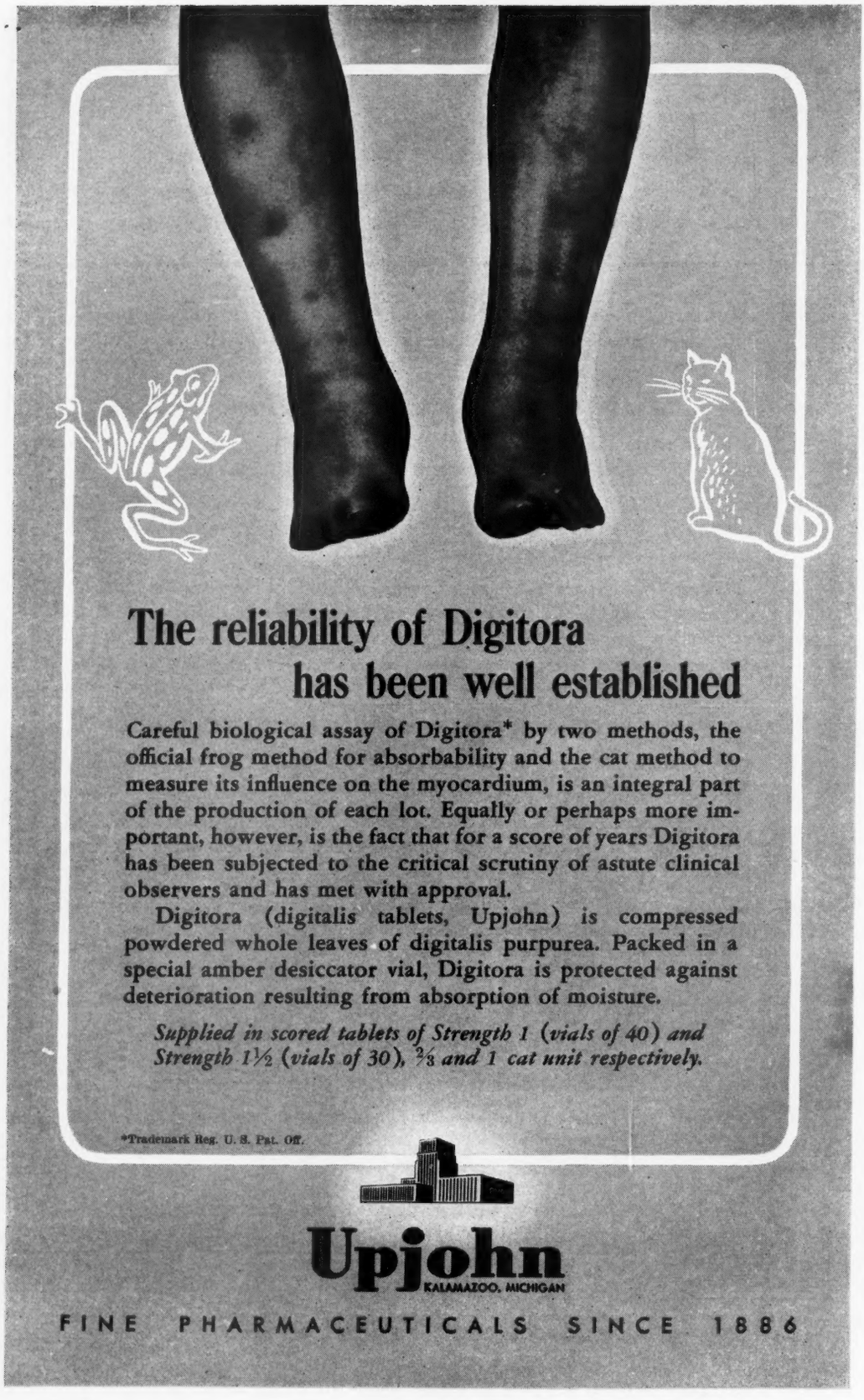
Send This Coupon for Useful Dietary Booklets

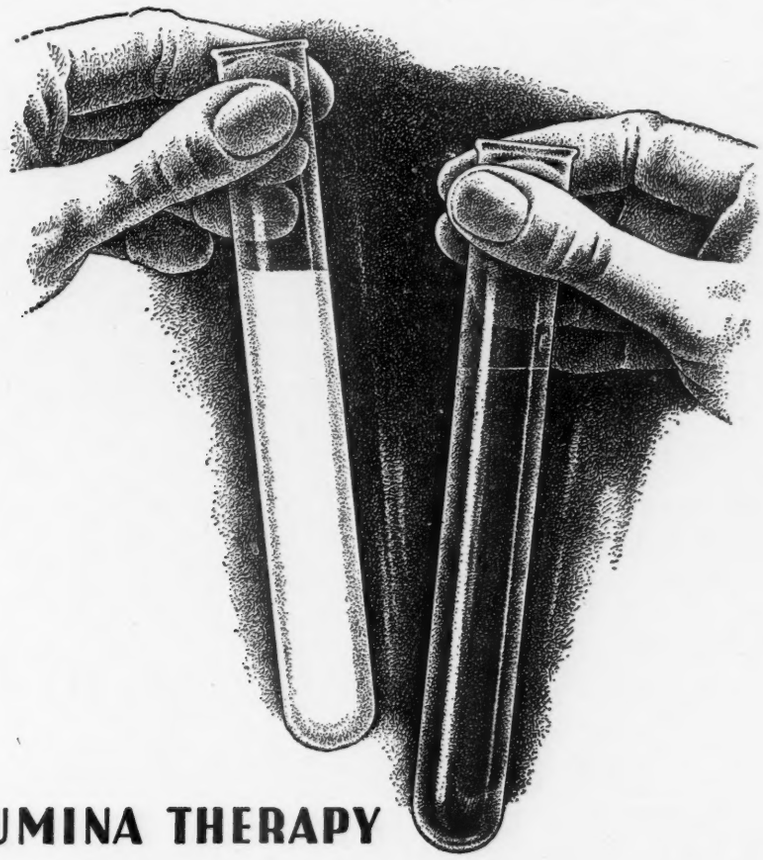
☐ *Feeding Sick Patients* ☐ *The Diabetic Diet* ☐ *Peptic Ulcer*
☐ *The Protein Value of Plain, Unflavored Gelatine, including amino acid analysis*
☐ *Reducing Diets and Recipes* ☐ *Infant Feeding*

KNOX GELATINE, Johnstown, N. Y., Dept. 451
Please send me FREE booklets for the medical profession as checked.

Name.....

Address.....


The reliability of Digitora
has been well established
Careful biological assay of Digitora* by two methods, the official frog method for absorbability and the cat method to measure its influence on the myocardium, is an integral part of the production of each lot. Equally or perhaps more important, however, is the fact that for a score of years Digitora has been subjected to the critical scrutiny of astute clinical observers and has met with approval.
Digitora (digitalis tablets, Upjohn) is compressed powdered whole leaves of digitalis purpurea. Packed in a special amber desiccator vial, Digitora is protected against deterioration resulting from absorption of moisture.
Supplied in scored tablets of Strength 1 (vials of 40) and Strength 1½ (vials of 30), ⅔ and 1 cat unit respectively.
*Trademark Reg. U. S. Pat. Off.
Upjohn
KALAMAZOO, MICHIGAN
FINE PHARMACEUTICALS SINCE 1886



IS ALUMINA THERAPY POSSIBLE *WITHOUT CONSTIPATION?*

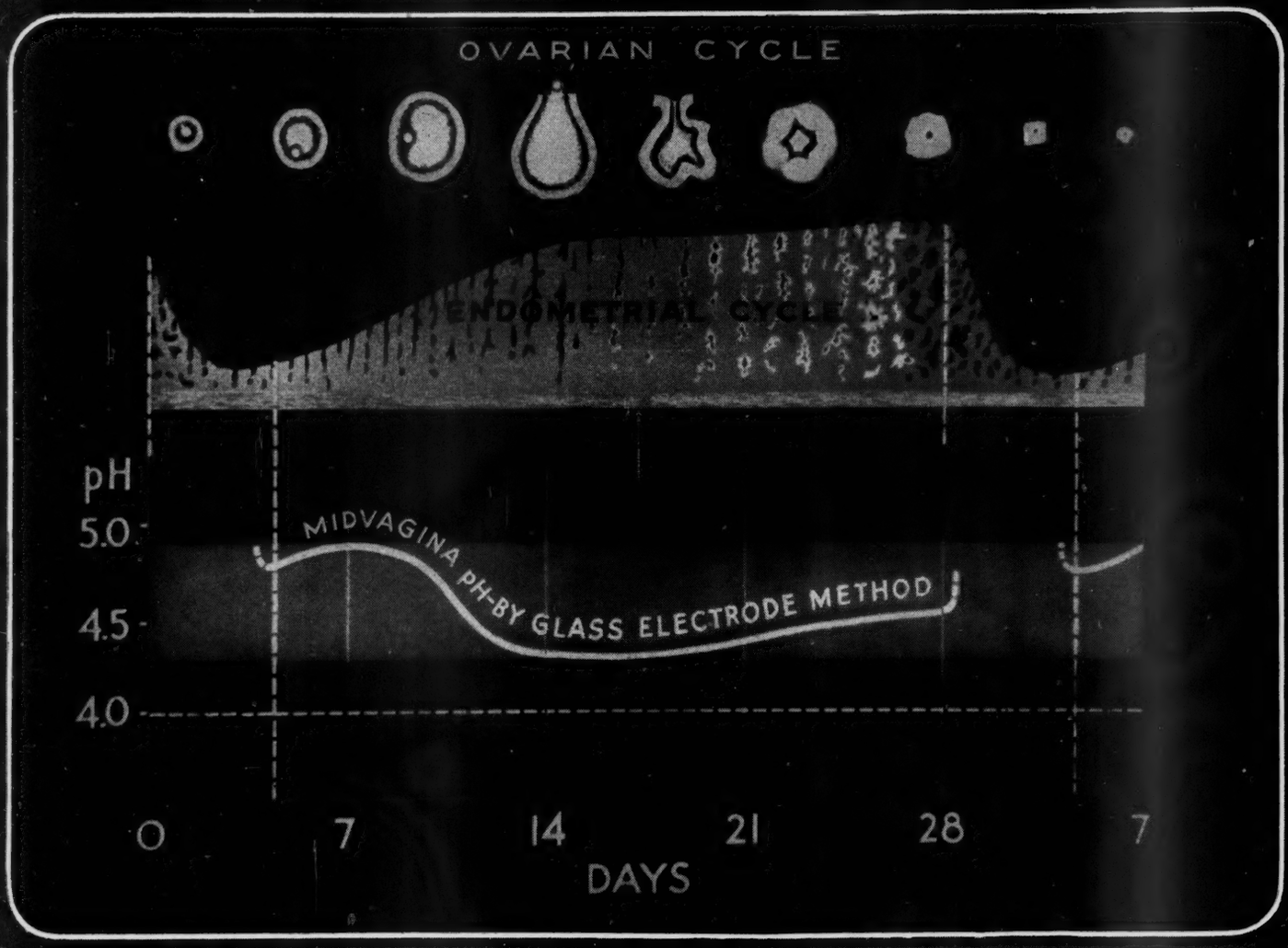
The answer is "yes" — when GELUSIL is used. For Gelusil forms no astringent aluminum chloride as a result of reaction with gastric hydrochloric acid.

The alumina-gel of Gelusil is so prepared—by a new and special process of activation—that it does *not* form the soluble chloride salt but remains the effective, insoluble adsorptive and non-constipating alumina throughout its course in the intestinal tract. Coupling this constant alumina with the well-known antacid magnesium trisilicate has produced a preparation that provides alumina gel therapy at once free from constipating effects and prompt and prolonged in action.

Why not drop us a note on your letterhead if you are interested in obtaining a trial supply of Gelusil?

WILLIAM R. WARNER & CO., Inc.

113 WEST 18th STREET - - - NEW YORK CITY



ORTHO-GYNOL APPROXIMATES

Normal Vaginal Acidity

• The maintenance of normal vaginal acidity is desirable to discourage invasion by foreign or pathogenic organisms. Reports indicate that most types of vaginal infections are usually accompanied by a reduction in vaginal acidity. The pH of Ortho-Gynol conforms with the normal vaginal pH and tends to fortify this important bio-chemical balance. Because of this, Ortho-Gynol is used frequently in the management of certain vaginal infections. Physicians prescribe Ortho-Gynol because it is not only efficacious but is physiological and does not disturb the normal vaginal flora.

ORTHO PRODUCTS, INC., LINDEN, NEW JERSEY

COPYRIGHT 1941, ORTHO PRODUCTS, INC.

ortho-gynol

VAGINAL JELLY

ORTHO-CREME **ORTHO DIAPHRAGMS**

The American Journal of Surgery

ADVERTISERS INDEX

Instruments and Apparatus

Austenal Laboratories, Inc.	24
Bard-Parker Co., Inc.	25
W. A. Baum Co., Inc.	1
Crescent Surgical Sales Co., Inc.	33
General Electric X-ray Corp.	17
Fred Haslam & Co., Inc.	35
Parker, White & Heyl, Inc.	25
Picker X-ray Corp.	21
Geo. P. Pilling & Son Co.	10
J. Sklar Manufacturing Co.	6
Edward Weck & Co., Inc.	5

Sutures

Davis & Geck, Inc.	*Insert facing 2nd Cover*
J. A. Deknatel & Son, Inc.	30
Johnson & Johnson	8, 9

Pharmaceuticals

Abbott Laboratories	18
Alba Pharmaceutical Co., Inc.	19
American Hospital Supply Corp.	11
The Arlington Chemical Co.	*October*
The Armour Laboratories	*October*
Baxter Laboratories, Inc.	11
Chatham Pharmaceuticals, Inc.	*October*
Ciba Pharmaceutical Products, Inc.	*4th Cover*
Hoffmann-La Roche, Inc.	2
Hynson, Westcott & Dunning, Inc.	*September*
The Lavoris Company	36
Lederle Laboratories, Inc.	12
Thos. Leeming & Co., Inc.	*October*
E. C. Lientz & Co., Inc.	24
Eli Lilly and Company	13
Mallinckrodt Chemical Works	29
Merck & Co., Inc.	14
Ortho Products, Inc.	40
Parke, Davis & Co.	15
Petrogalar Laboratories, Inc.	28
Schering Corporation	23
Schering & Glatz, Inc.	*October*
E. R. Squibb & Sons	7
Frederick Stearns & Co.	*October*
The Upjohn Co.	38
Wallace & Tiernan Products, Inc.	30
Wm. R. Warner & Co., Inc.	16, 39
Winthrop Chemical Co., Inc.	20
John Wyeth & Bro., Inc.	22

Hospital Supplies

American Hospital Supply Corp.	11
Baxter Laboratories, Inc.	11
Becton, Dickinson & Co.	*October*
Crescent Surgical Sales Co., Inc.	33
Duke Laboratories, Inc.	35
General Electric X-ray Corp.	17
Fred Haslam & Co., Inc.	35
Johnson & Johnson	*October*
Macalaster Bicknell Co.	*October*
Massillon Rubber Co.	33
Picker X-ray Corp.	21
J. Sklar Manufacturing Co.	6

Post-Graduate Instruction

Cook County Grad. Sch. of Med.	27
N. Y. Polyclinic Med. School	27

Foods

Chas. B. Knox Gelatine Co., Inc.	37
The Wander Company	*October*

Miscellaneous

The American Journal of Surgery	31, 34
General Information	4
Iodine Educational Bureau, Inc.	36
New Modern Drugs	32
Society Meetings	26

WITHERING HEIGHTS

DIGIFOLINE, *"Ciba"* offers the physician a digitalis that may be said to reach the heights of Withering's therapy.

DIGIFOLINE *"Ciba"*

While disputes have raged as to the best method of standardization, Digifoline has not changed in rigidity of potency testing for many years. The physician can always be sure of this:—one tablet, one cc. of liquid, or one (2 cc.) ampule of Digifoline* is equivalent to one cat unit. To sum up: this digitalis preparation is uniform and Ciba is constantly on guard to maintain this high standard. No glycerine or alcohol is present in the ampules, thus eliminating any irritation produced by these substances.

Oral, intravenous, intramuscular or rectal administration in auricular fibrillation, congestive heart failure, loss of cardiac tone, etc.

*Trade Mark Reg. U. S. Pat. Off. Word "Digifoline" identifies the product as digitalis glucosides of Ciba's manufacture.

C · I · B · A

CIBA PHARMACEUTICAL PRODUCTS, Inc., SUMMIT, N. J.